AMERICAN RAILROAD ECONOMICS

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AMERICAN RAILROAD ECONOMICS

A TEXT-BOOK FOR INVESTORS AND STUDENTS

BY

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PREFACE

This book is the product of the author's activities as an investment analyst in New York and as an instructor in Railroad Finance at the *New York University School of Commerce, Accounts and Finance.* The subject, hitherto, has not been given the attention and the critical analysis commensurate with its importance. The large amount of statistical data and other information contained in the annual reports of the railroads are generally accepted without much inquiry. The work that has been done thus far by professional analysts and railroad statisticians aims to gauge railroad activities by the use of rigid standards and definite mathematical formulae. In these pages no attempt is made to lay down rules or maxims. No tables of "averages" are presented as final evidence of railroad status or progress. The purpose throughout is a critical examination of facts and figures derived from railroad reports and other publications with a view to assisting in the correct judgment of railroad activities and operating results.

INTRODUCTORY

In no other country and at no previous time have railroad operations received as much attention as at present in the United States, and it is doubtful whether these matters have ever been more flagrantly misinterpreted. The economic importance of American railroads and the participation of the people as individual investors in their rapid growth and development creates a demand for the proper understanding of railroad activities and operating results. Government regulation under the Interstate Commerce Act has promoted and assisted this demand. The publications of the Federal and State commissions are now as important sources of statistical information as the reports issued by the individual railroad companies. These published statistical returns are in many ways useful to the railroad manager, to the investor and to the public. The expensiveness of compilation and the liability to abuse and misinterpretation render necessary the utmost wariness and care in analyzing such data.

It is because of the difficulty of arriving at satisfactory standards that railroad statistics are extremely troublesome to formulate. There are many factors to be considered outside of the bare figures and the relative values of these factors are con-

stantly changing. All modern countries desire a satisfactory stable unit by which operating results as between different railroads and at different periods of time may be unmistakably presented to the public. Uniformity of statistics, however, does not admit of an actual and final comparison of one railway with another, or of the operations of one period with another period, nor do "averages" covering an endless variety of lines and systems form a wholly reliable basis for judging results. The Pennsylvania and the Philadelphia & Reading Railroads, for example, are ordinarily held to be competing roads of the same standard of financial soundness and operating efficiency. The Pennsylvania, however, has a traffic amounting to many times that of the Philadelphia & Reading. Moreover, the characteristics of the two lines are in many respects different. The Reading is practically a terminal road, while the Pennsylvania branches out in all directions and extends over almost half of the Continent, carrying a great volume of through traffic. It is necessary, therefore, in any comparisons between these two systems, to take into account the relative proportions of terminal work, the nature of the traffic and the length of the haul and other similar factors. Unless this is done, a comparison of the operating results based entirely on statistics would be quite misleading.

Another cause of the defects in the use of railroad statistics is the misunderstanding of the real significance of each statistical item. Too little or too

much emphasis may be placed on the material used. The soundness of statistical logic in general requires that the intrinsic worth of the figures presented be fully recognized. Lack of appreciation of this fact frequently leads to erroneous analyses and improper comparisons. Moreover, unless a statistical analysis is of some distinct value to the railroad executive or manager, to the investor, or to the statesman and the public at large, work of this character cannot be economically justified. In other words, each class of railroad data should have an underlying purpose and should be compiled, classified and interpreted to accord with this purpose.

Having in mind these considerations the materials forming the basis of this book are classified as follows:

(1) *Data relating to the character of the transportation facilities.* Hereunder are analyzed the physical features of railroads in so far as they influence railroad operations and indicate the adjustment of transportation facilities to traffic demands.

(2) *Data measuring efficiency and economy of operation.* These are the so-called traffic or "mileage" statistics, indicating the nature and volume of the traffic, and the cost in transporting and in handling the same, expressed under proper terms and in standard units.

(3) *Data measuring revenues, expenses and net earnings.* Herein is comprised the study of the *Income Account* and *Profit & Loss Account.*

(4) *Data measuring the capital investment in rela-*

tion to the corporate resources and liabilities. Analyses of the *General Balance Sheet* and, more particularly, *Capitalization* are afforded by this class of material.

In order that these topics may be more clearly understood preliminary chapters are inserted, treating of railroad rates and railroad securities and describing the important railroad systems of the United States.

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CHAPTER I

RAILROAD RATES

Economic Theory of Rates. The economic basis of railroad rate making is that the charge for the service shall permit a profit both to the shipper (or passenger) and to the carrier. If the rate is such as not to afford the shipper a profit through the transportation of his goods, he will dispose of them at home and the railroad will lose the business. On the other hand, if the rate is so low that the carrier directly or indirectly obtains no profit, the service is no longer a field for business enterprise. This principle applies to individual rates as well as to the general level of charges. It is somewhat obscured by the heterogeneous character of railroad traffic and the wide disparities and the complexities in existing rate structures. There are undoubtedly many instances when goods and persons are accepted for transportation at rates which yield revenue less than the direct cost of performing the service. Usually, however, such rates are fixed with a view to assisting or promoting other and more remunerative traffic. The service in this case is preliminary or auxiliary

to a further service. Thus, raw materials are frequently hauled at a loss because in this way the railroad company is enabled to obtain the traffic arising from the movement of the finished product. Similarly, very low commutation rates are granted to passengers travelling between cities and suburban districts so as to promote the growth of these localities and thus furnish a local movement of merchandise to supply the needs of increasing suburban population. Under these conditions, rates are adjusted so as to give the railroad a maximum net return on its operations.

The margin of the charge within which a railroad company can profitably conduct business and the public can furnish business varies with each class of traffic and with each journey or shipment. It is exceedingly difficult to determine even approximately without actual tests. Fluctuations in the price of commodities and in wages, changes in economic and industrial conditions and in the supply of available traffic are continually altering the price margin beyond which the seller or the purchaser of the service, or both, may suffer an economic disadvantage. The nature of some commodities, in respect to *value, bulk, and relative ease or difficulty in handling,* may permit a wide range between the lowest and the highest rate at which they may become a part of railroad traffic. There are a number of commodities, on the other hand, for which the range is exceedingly narrow. A slight change in the rate may cause an economic burden on the shipper,

or on the railroad. Let us assume that manure obtained in a city somewhat distant from farm lands is offered for transportation. The value of this article in proportion to bulk is very small. Unless the transportation rate is low, it will not pay to have it shipped to the farms where it has a value. The railroad company, on the other hand, cannot make a direct profit from the transportation, unless the rate is high enough to cover the expense in furnishing the service. It can be readily seen in this case that the adjustment of the rate must come within a very narrow margin, otherwise the commodity will not become an article of railroad traffic. But the shipment of manufactured silk from one locality to another, or even from one continent to another, would be very little affected by a slight increase or decrease in the freight rate. In almost any region, the transportation cost of silk would be but a very small fraction of its market price. On commodities of this nature the range of adjustment of freight charges permits a wide choice of rates.

The necessity of distinguishing in rate making between the kinds of commodities and the sources of traffic has engendered the principle known as "charging what the traffic will bear." This expression, as pointed out by Mr. Acworth,[1] has acquired an ill repute. It is commonly defined as veiled extortion. Yet, it represents the only economic principle of developing commerce and industry with modern transportation facilities.

[1] Elements of Railroad Economics, p. 75.

Of recent years, in the discussion of rate questions there have been endeavors to distinguish between charges based on *the value of the service* and charges based on *the cost of the service.* By "value of the service" is meant what the public can afford to pay for the service, whereas the "cost of the service" is all the expenses of the carrier in performing the service. Taken alone, as an explanation of rates, these two theories "do little more than to base rates for the most part on themselves and on each other." As pointed out by Prof. John M. Clark, "The value of a transportation service is sometimes defined as the difference between the price of the commodity in question at the point of shipment and the price at the destination. . . . The suggestion is altogether deceptive, for the difference in price itself depends on the transportation charges." [1]

The *cost of service* theory is likewise unsatisfactory for by no manner of means can railroad costs be measured or applied directly to particular railroad services. The transportation cost of each class or kind of commodity not only differs, but each item of traffic at any given time and at each haul has a different cost. Cost is the resultant of all conditions under which the transportation business is done. As is pointed out on page 145, one of the chief elements affecting cost in railroad operations is *traffic density* (i. e. volume of traffic). The more business done, the lower the cost of performing each unit or item of

[1] "Standards of Reasonableness in Local Freight Discriminations," by John Maurice Clark, Ph.D., pp. 52–53.

business. The rates themselves, however, influence the volume of business. Accordingly, to base rates entirely on cost would be attempting to find one unknown quantity by using another.

Railroad Rate Regulation. Notwithstanding the impracticability of establishing definite and concrete standards of rate making or in determining criteria for rate reasonableness, transportation charges have become matters of government regulation and supervision. A railroad, even though privately owned and operated, is an instrument of public service. Its rates and charges affect closely the public welfare. The self-interest of the railroad company in the fixing of rates is not to be permitted to have full play. In other words, private gain, though a motive for railroad operation, is controlled by a higher motive, namely, public welfare. This does not mean that private gain and public welfare are opposing forces. In fact, no system of transportation charges will long prevail, where either force is neglected.

The fundamental importance of reasonable freight rates as affecting the general welfare in the United States can hardly be exaggerated. Probably in no other civilized country do railroads play as important a part in economic and industrial development as they do in the United States. The long distances separating leading industrial centers, the varying character of geographical divisions, the diversity of natural resources and the broad expanses of undeveloped and partially developed territory, all combine to make the great transportation agencies fore-

most factors in industrial affairs. Railroad progress, both physical and financial, is therefore, a matter of grave public concern.

The close dependence of public welfare on the railroads in the United States led to the creation of a governmental regulating body, the Interstate Commerce Commission. Since the passage of the Act of 1887 creating this commission, Federal control over railroads has been broadened and intensified. Each amendatory act or supplementary statute has augmented the powers and duties of the Interstate Commerce Commission, until no other tribunal of the Government has, at present, such extensive functions or is burdened with such onerous duties. Primarily established to detect rate discriminations and abuses, the Interstate Commerce Commission has developed an organization for determining and controlling both the rate making and the operating activities of the railroads.

The original Interstate Commerce Act of February 4, 1887, furnished no definite theory for determining reasonable rates or rate discriminations; none could be adopted without the sanction and approval of the courts. The lack of definiteness in the wording of the organic law, resulted in a series of conflicting legal opinions which greatly hindered the Commission in its activities. At the beginning the Commission refrained from claiming the right to prescribe "reasonable" rates, though the fact soon became apparent, that as an effective rate regulative tribunal it must "make" as well as

"break" rates. The Commission endeavored as far as possible to enlarge its usefulness by assuming the power of prescribing specific rates in lieu of those condemned as unreasonable. The legality of this process, however, was disputed, and when submitted to the courts, failed to receive judicial approval.[1]

Legal decisions and legislative enactments during the first twenty years hampered the activities of the Interstate Commerce Commission. Inasmuch as appeals from the decisions of the Commission necessitated an entire review of evidence, nothing was gained from its labors, either in the expedition or final adjudication of rate controversies. During this period the Interstate Commerce Commission, moreover, was not concerned with the reasonableness of the general scale of freight charges, chiefly because of the absence of serious complaints on this score. Modifications in freight classifications in 1900, combined with the public dissatisfaction over the inefficacy of the Interstate Commerce Act, made the question of freight rates prominent. About this time, also, traffic congestion on the railroads produced unsatisfactory transportation service, the outcome of which was a clamor for additional legislation, culminating in the Hepburn Act of June, 1906.

The Hepburn Act as finally passed, though it granted the Commission power to prescribe a rail-

[1] New Orleans and Texas Pacific Railway vs. Interstate Commerce Commission, 162 U. S. 184; also "Maximum Freight Rate" Decision, 167 U. S. 479.

road rate in lieu of one declared unreasonable, was merely a stepping-stone to complete rate control. Further legislation regulating freight rates was enacted by Congress in 1910, when the Commission was given full power to suspend all changes in freight rates for a maximum period of six months pending an investigation of the reasonableness of the changed rates. Thus, the Interstate Commerce Commission has full rate fixing powers. Through its decisions it can seriously affect both the earning power of the railroads and the welfare of the public.

The ultimate outcome of the rate determining power of the Interstate Commerce Commission is indeed problematical. The elements of permanency and rigidity in rates, which are incompatible with changing economic conditions, is not obviated even in the absence of Government rate control. Rate making of itself is such a delicate and complicated task that when a scale of charges is once established, railroad managers, in spite of competitive forces, are loath to make adjustments warranted by economic conditions. It is from the stereotyped rates of the last generation that the railroads find it very difficult to free themselves by establishing new rate schedules.

Interstate and Intrastate Rates. One of the principal obstacles to efficient Federal rate regulation is the power held by each State to control rates on traffic within its borders. These *intra*state rates have become exceedingly burdensome to the railroads. In order to escape them, the claim was

made in a number of cases that these rates were an interference of interstate commerce and, therefore, unconstitutional. The result of this litigation was made known in the *Minnesota Rate Cases* decided by the Supreme Court on June 9, 1913. The Court held:

(1) That the Constitution gives Congress an authority at all times adequate to secure the freedom of interstate commercial intercourse from State control and to provide effective regulation of that intercourse as the national interest may demand.

(2) That control of commerce confined within one State and not affecting other States is reserved to that State.

(3) That even without action by Congress the commerce clause of the Constitution necessarily excludes States from direct control of subjects which should be prescribed by a single authority.

(4) That there remains to the States the exercise of the power appropriate to their territorial jurisdiction in making suitable provision for local needs.

The effect of the decision is to sustain the power of the State railroad commissions and State legislatures to fix two-cent passenger or other rates on business exclusively within the States, *provided always that the rates are not confiscatory.* The Supreme Court holds further, however, that Congress has the power to override State authorities as regards the fixing of rates which will affect interstate business whenever it shall seek to exercise such authority. It is not through a lack of power, but because Con-

gress has failed to exercise that power, that the Supreme Court decided against the railroads.

A problem arising from the intrastate rate regulation is whether a State authority can fix a rate which in effect constitutes a discrimination against localities in other States. This is the interesting contention in the *Shreveport Case* [1] in which the Interstate Commerce Commission set aside rates fixed by the laws of Texas. The fight against the Texas rates was begun by the Louisiana Railroad Commission before the Interstate Commerce Commission. The Louisiana authorities set forth that the low rates forced upon the railroads on intrastate traffic within the State of Texas gave a very pronounced advantage to shippers from Houston and Dallas, to other points in Texas, as against shippers from Shreveport, La., to Texas points about equally distant between the Texas and the Louisiana shipping centers. In making its order the Interstate Commerce Commission expressly declared that rates fixed by State law within the limits of Texas constituted a discrimination against points outside the State, and several railroads were directed to disregard the low rates imposed on traffic within the Texas limits. The Commerce Court has sustained the order of the Interstate Commerce Commission.

Sectional Competition and Rate Adjustments. Along with the Government's responsibility, in freight rate adjustments, for national progress and railroad welfare, the problem of sectional competition and

[1] See 23 I. C. C., p. 31.

traffic distribution must be considered. Probably the most influential factor in causing rate discriminations is the profound dissatisfaction of many communities with their status in competing for the distribution of their products with other communities better situated geographically. These communities are far less concerned about obtaining low rates than about securing such rates as may place them in a favorable competitive position with other sections. The Interstate Commerce Commission, in dealing with proposed rate changes, finds itself much more hampered by the conflicting claims of competing localities than by the troubles of determining whether given rates are in themselves reasonable. The Commission can completely alter or destroy traffic relationships by merely reducing some rates and not reducing others. That it has this right has been tentatively upheld by the Supreme Court in the Missouri River Rate Cases.[1] The question in these cases was the validity of the Commission's order reducing certain rates charged on through freight from the Atlantic seaboard to Missouri River cities. These rates had been made up by adding to the rate from the Atlantic seaboard to the Mississippi River the full local rate from the Mississippi River crossings to the cities on the Missouri River. Thus a general class rate per hundred pounds from the seaboard to the Mississippi River was 87 cents, and the rate thence to the Missouri

[1] Interstate Commerce Commission vs. the Chicago, Rock Island & Pacific R. R., et al., U. S. 218 p. 88.

River points was 60 cents, making $1.47 the joint rate. The Commission ordered a reduction to $1.38, a difference of 9 cents. The Circuit Court in restraining this order of the Commission, held that the reduction gave undue advantages to the Atlantic seaboard manufacturers and jobbers against the competition of manufacturers and jobbers in both the Missouri River and intervening territory; and that this rearrangement of competitive traffic conditions was not within the powers granted to the Interstate Commerce Commission. The Supreme Court (by a decision of four judges against three) reversed this judgment.

"Long and Short Haul" Rates. The problem of traffic distribution on an equitable basis involves consideration of "long and short haul" charges and water competition. The Interstate Commerce Act provides that the railroads shall not charge more for a short haul than a longer one over the same line in the same direction except with the express authorization of the Interstate Commerce Commission upon application by the carrier and after investigation. The principal justification for higher shorter haul rates than are granted for longer hauls on the same line is competition both of paralleling rail lines and of water transportation. Through rail rates from the Atlantic to the Pacific seaboard, for example, (whenever it was deemed profitable for the railroads to hold the traffic), were made low enough to meet the water rates between these points. The rates to important inland points, even at considerable

distance from the coast terminals, were frequently a good deal higher. As a general rule in transcontinental traffic, the rates to "inter-mountain" points, such as Spokane, Salt Lake, Denver and Reno, were made to approximate the charge to the Pacific coast points, plus an additional "back-haul" rate. This made the coast terminal cities the distributing points inland and prevented the growth of interior traffic centers as rivals to those on the coast. Thus, the system of "long and short haul" rates arising from water competition determined to a large extent the location of industries and the geographical development of trade.

A recent decision of the Commission which attracts the most attention with reference to water competition is the verdict in the Spokane Rate case.[1] In this controversy the most important contention of the railroads was the existence of water competition centering about Spokane. Traffic from the Atlantic seaboard to any destination like Spokane could be moved by water to the coast and thence by rail to the interior point. A competitive rail rate to the interior point, therefore, would be the sum of the water rate plus the rail rate from the coast. As a result of a previous decision, however, the rate to Spokane from the East had been reduced to 75 per cent. of the rate to the coast cities, plus $16^2/_3$ per cent. of the local back-haul rate. The coast cities complained that this adjustment gave a competitive

[1] City of Spokane, et al. vs. Northern Pacific, et al., Interstate Commerce Commission, Opinion No. 1363.

advantage to Spokane as a distributing center. The Commission, however, did not accept the contention of the coast cities, but expressed a doubt whether the railroads should be permitted to construct a tariff for the express purpose of compelling the manufacture or the merchandizing of a given commodity at Chicago, or upon the Missouri River, or at any other place. The Commission, moreover, denied that the railroads were at liberty to meet water competition "in whatever way or to whatever extent they see fit." In other words, the railroads are not allowed to consult merely their own interests or the desire of the communities which they serve.

A further problem involved in the equalization of traffic distribution by means of freight rates is the competition of home- with foreign-made products. The position taken by the Commission with respect to the relation between railroad rates and foreign competition in similar goods is indicated in the California citrus fruit cases,[1] in connection with the rates charged on lemons. The world's supply of lemons is chiefly produced in two localities—Sicily and Southern California. The cost of producing lemons in Sicily is much less than in California, as labor enters largely into the cost of production. In spite of a protective duty of $1 per hundred pounds (increased by the Payne Tariff Act to $1.50 per hundred pounds) the low water transportation charges available to the Sicily lemon prohibited the sale of the California product in territory east of the Missis-

[1] 19 Interstate Commerce Commission Report, p. 148.

sippi River. The Commission decided that an increase in the rate from \$1.00 to \$1.15 per hundred pounds on California lemons to the Eastern seaboard, established since the passage of the Payne Tariff Act, was exorbitant, and that the old rate of \$1.00 per hundred pounds should be restored, in order to permit the sale of "home grown" lemons in Eastern territory. If the principle inferred from this decision is applied generally, its economic importance cannot be ignored, since it may be made to apply in every instance where the tariff is inadequate to protect against foreign competition.

Rates and Changes in Economic Conditions. Aside from the problems of rate adjustment required by the immediate exigencies of trade and traffic distribution, modifications in systems of rates are constantly necessary in a rapidly growing country to keep pace with changing economic conditions.[1] This point is well brought out in the complaint of the Lincoln (Nebraska) Commercial Club, decided April 6, 1908.[2] Concerning this case, Professor Ripley writes:

> Lincoln, Nebraska, lies about 55 miles southwest of Omaha. Originally all its supplies came from the East, as both cities were for a time outposts of civilization. The coal supplies came from Iowa and Illinois and the salt from Michigan. On these and most other commodities the rates to Lincoln were made up of a through rate from the East to the Missouri River, plus the local rate on to destination. The city of Lincoln thus paid considerably more than Omaha for all of its supplies. Gradually condi-

[1] For an excellent discussion of this question see Professor Ripley's "Rate Making in Practice," *Railroad Age Gazette*, June 4, 1909.

[2] Interstate Commerce Commission, Opinion No. 1102.

tions have changed, until in 1907 it appeared that over half the soft coal consumed in Lincoln was brought from Kansas and Missouri; four-fifths of the lumber from the South and nearly all the rest from the Pacific coast; gas and salt from the gas belt and salt beds of Kansas and a great deal of beet sugar from the western fields. For a large proportion of these and other supplies, Lincoln was actually as near or nearer the point of production than Omaha, and yet the difficulties of effecting an adjustment between rival carriers had prevented any *modification of rates corresponding to these changes in economic conditions.*[1]

Adaptation to business changes is an essential element of successful railway operation and development. American railroad managers, urged by competitive railroad building, must be active and alert in seeking new territory and new traffic. A strong contrast between Europe and the United States lies in the fact that the European railroads generally *take* business as they find it; whereas, the American railroads are forced to *make* business.

[1] "Railroad Rate Making in Practice," *Railroad Age Gazette*, June 4, 1909, p. 1167.

CHAPTER II

RAILROAD SECURITIES

Railroad securities are of two general kinds: (1) *Capital Stock,* representing certificates of proprietorship and (2) *Funded Obligations,* representing certificates of indebtedness. The owner of shares of stock is theoretically a partner in the enterprise, whereas the holder of certificates of indebtedness (whether bonds, notes or warrants) is a creditor. The entire capital stock and funded indebtedness of a railroad company constitutes its *capitalization.*

Capital Stock. Capital stock is the primary form of capitalization. Legally, it represents the fund subscribed by owners of a corporation for the purpose of enabling it to conduct business and to obtain credit as a corporate entity. The form of the certificates are in *shares* usually of $100 each. Some of the leading railroad companies, notably the Pennsylvania, the Lehigh Valley and the Reading have $50 shares. This unit of value of the shares is known as the *par value* or *face value.*

Shares of capital stock usually represent permanent and negotiable interest in the corporation issuing them. If this interest is terminable, it is only so at the option of the corporation. Though the corporation is theoretically liable to shareholders and

creditors for the money value represented by the stock certificates, this liability cannot be enforced by the shareholders on any maturity date or as long as the corporation is an active, "going concern." Shares of stock, however, are sometimes issued under contracts whereby the issuing corporation reserves to itself the right to retire them at its option. This right may be absolute or subject to conditions expressed in the contracts whereunder the shares were issued. Moreover, the whole or a part of the body of stockholders may agree to an alteration of the terms under which the stock has been issued. All these matters are subject to legal restrictions and to the charter provisions which are binding upon the corporation.

The fact that the stockholder is theoretically a "proprietor" and not a "creditor" settles upon him certain of the rights and duties of proprietorship. These, however, are only "equitable" rights and duties. They can be exercised only in respect to the same rights and duties of the other shareholders. The stockholder, therefore, cannot exercise the common rights of individual proprietorship as against the property or the business of the corporation. He cannot, in an individual or private capacity, sequester all or any part of the property or assets. He, personally, is not permitted to examine the books of account or to interfere with the corporation's affairs unless as an authorized agent or officer of the corporation acting in accordance with its by-laws. On the other hand, the stockholder, in a

private capacity is not personally liable for claims against the corporation and is not responsible for its acts. This arises from the legal principle of "limited liability," on which corporate business enterprise is based. The full import of this ancient principle, however, may be altered by State and Federal legislation. Railroad companies, like all other business corporations, are creatures of legislative enactment. They draw their powers from a charter with which they are legally bound to comply in their relations to the public, to their creditors and to their stockholders.

One of the principal rights usually pertaining to stock ownership in a corporation is the privilege of a *pro rata* vote in determining certain questions relative to its affairs. The stockholders generally have the right of participating in the election of the officers or directors. They also share in proportion to their holdings in the distribution of surplus profits. These matters, however, are specifically determined by the provisions of the railroad charter or by the terms of the contract under which the shares of stock are issued.

The voting privilege attached to shares of capital stock may be surrendered by the stockholder through a *voting trust agreement*. This means that the actual certificates of capital stock are lodged with several trustees, who hold the same in the interests of the owners, and who issue in return *voting trust certificates* representing the actual shares. Thus, a majority of stock of the Southern Railway is deposited with

three voting trustees under a voting trust agreement which shall remain in force until terminated by a majority vote or as long as the trustees shall so elect. The purpose of the voting trust agreement is to assure a permanent managerial policy for the corporation. Since each person or group of persons owning stock to which voting right is attached has as many votes as the number of such shares held, managerial policy is determined by the majority of the number of votes cast. The control of the corporation's affairs, therefore, is technically in the hands of the majority of shares exercising the voting privilege. In order that one or a group of persons may obtain the administrative control of a railroad company it is merely required that they own or control the voting privilege possessed by a majority of voting shares.

As a rule, railroad stockholders, unless they hold a substantial interest in the voting capital stock, do not exercise their voting privilege in person. The voting can only be done by attendance at stockholders' meetings. The wide distribution of railroad stockholders throughout the world prevents many from attending these meetings. Moreover, the expense in many instances is too great. The stockholders' meetings of American railroads therefore are usually perfunctory affairs. They are attended mainly by the directors who constitute the controlling group of stockholders. In fact, no leading American railroad company could accommodate in one building at one time the total number of its

shareholders. The Pennsylvania Railroad Company, on June 30, 1912, had over 80,000 separate stockholders; the Union Pacific, New York Central and other leading companies also have their shares in a large number of hands.

Most of the railroad stockholders that exercise the voting privilege do so through proxy. It is the practice of the directors of each corporation conjointly to request these proxies. Proxy blanks by which the voting privilege is transferred are usually inserted with the notices of stockholders' meetings. It occasionally happens that interests opposed to the controlling management of the railroad also request proxies. In this way stockholders can have a voice in the selection of the management and the policy of the company.

The contest for the managerial control of the Illinois Central Railroad illustrates an appeal for proxies by opposing interests. The late E. H. Harriman, through the purchase by the Union Pacific Railroad of approximately $33,000,000 of Illinois Central Railroad stock, acquired a predominant influence in the affairs of the company. He was opposed to the policy of its president, Mr. Stuyvesant Fish, and succeeded in removing him from this office. Mr. Fish, also a large owner of Illinois Central stock, in order to regain his position sent out a general request for proxies to be used at the next stockholders' meeting convened for the purpose of electing directors. Contests of this kind are frequently avoided by one of the contestants obtaining by

purchase or otherwise enough shares to control the election.

The certificates of capital stock of railroad and other corporations are negotiable. Thus, the right of proprietorship can be disposed of at any time. The transfer of the ownership, however, must be known to the corporation. In other words, the legal transfer can take place only by a record on the books of the corporation and through an authorized transfer agent. Hence, each corporation has a register of stockholders. This is known as the "Stock Book." In most States it is the only book of account to which the stockholder of a corporation has legal access. The stockholder may thus know who are the other participants in the proprietorship of the company and the amount of the holdings of each.

Classes of Capital Stock: The capital stock of American railroads are of two general classes; (a) *Preferred Stock* and (b) *Common Stock.* In Canada and Great Britain there is a third class known as *Debenture Stock.* This consists of shares which are issued with the agreement to pay absolutely at specified intervals a fixed rate of return. It is therefore a form of irredeemable indebtedness bearing a stipulated rate of interest. The holder is usually entitled to a voting privilege.

Preferred Stocks. *Preferred Stocks* may be First Preferred, Second Preferred, Third Preferred and the like. They are so called because in their order they have prior claims upon earnings. Thus, the first preferred has the first claim up to a

specified rate of dividend, then the second preferred's claim is to be met. If there are no other classes of preferred stock the common stock participates as a claimant. Preferred stocks may be *cumulative* or *non-cumulative*, *participating* or *non-participating*. If *cumulative*, the amount by which the dividend at any dividend period fails to reach the stipulated rate is carried forward to continue as a claim upon earnings until satisfied; if *non-cumulative*, the unpaid amount of the dividend lapses. If a preferred stock is *participating*, it is not limited to a stipulated maximum rate of dividend, but is entitled to participate in further dividends, in accordance with the terms under which the stock is issued; if *non-participating*, it is limited to the stipulated rate.

Only a few American railroad corporations have more than one kind of preferred stock. The Erie and the Reading Company, for example, have both First and Second Preferred shares, all of which participate in earnings in their order up to 4 per cent. of their par value. This division of preferred shares into classes is the result of corporate reorganization and readjustment of capitalization. Its purpose is to meet the demands of preference claims against the bankrupt corporation by giving in return a preference claim up to a fixed rate on the surplus earnings of the newly created concern.

Railroad preferred stocks, with but few exceptions, are non-cumulative. If dividends are not earned or paid in any year, they lapse and the deficiency is

never made up. Thus, the Southern Railroad Company did not pay dividends on its preferred shares from October, 1907, to April, 1911, though during the greater part of that period the money required for this purpose had been earned. The Erie Railroad, likewise, for several years has not paid any dividends on its two classes of preferred stock. Thus, the payment of preferred dividends is largely a matter for the discretion of the directors. The only restriction on the directors is that they are not permitted to pay in any period a dividend to common shareholders until the maximum rate on the preferred stock has been paid in that period. The Rutland Railroad is the only railroad of any importance which has preferred stock on which the unpaid dividends are cumulative. In fact, owing to privilege given the common stockholders to exchange their shares into the preferred, almost all of the capital stock of this company ($9,057,600 of $9,257,000) consists of 7 per cent. cumulative preferred stock on which about 200 per cent. unpaid dividends have accumulated. The Pere Marquette has also a cumulative first preferred stock. A reorganization of the Company because of bankruptcy will probably eliminate this feature.

The preferred stocks of several leading railroad companies belong to the *participating class.* They participate under certain restrictions in profits beyond the fixed preference rate attached to the shares. The Chicago, Milwaukee & St. Paul Preferred Stock is entitled to a prior dividend of 7 per

cent. annually before any return can be paid on common shares. After the common stock has received 7 per cent. per annum both classes of stock share alike in further distributions from current income. In the case of the Chicago & North Western Railroad, after both shares have received dividends at the rate of 7 per cent. per annum, the preferred stock is entitled to 3 per cent. additional before any further return can be made on the common shares. The preferred shares of Chicago & North Western, however, do not participate beyond a maximum of 10 per cent. The Seaboard Air Line has a similar arrangement in the distribution of possible dividends to shareholders. Its preferred stock is entitled to 4 per cent. in dividends annually, after which the common stock is to get 4 per cent. Then the preferred is entitled to a further distribution of 2 per cent. before additional returns can be made to common stockholders.

The preferred stocks of many railroads are issued with the agreement that the company at its option has the privilege of redeeming these shares at a stipulated price. This retirement privilege was exercised by the Southern Pacific Company in 1909 when, approximately, $75,000,000 of 7 per cent. Preferred Stock was replaced by other securities. The stipulated redemption price was $115. The Hocking Valley Railroad, likewise, called in $15,000,000 of preferred stock, for which par value was paid the holders. The Erie, and the Reading, both reserve the right to redeem either or both classes of their

preferred shares at par. The Reading also has the option of converting its second preferred stock at any time, one-half into first preferred stock and one-half into common stock. The chief motive back of the redemption of preferred stock is the dislike of complications arising out of the respective provisions regarding the rights and privileges of the different classes of capital stock. Preferred shares, in many cases, have preference in the distribution of assets as well as of earnings. Although a railroad property is rarely liquidated, it occasionally happens that a part of the assets can be segregated and a distribution made for the benefit of shareholders. Complications arise when a basis of distribution equitable to both classes of stock is sought. The directors of the Union Pacific Railroad, for example, may experience some difficulty in any scheme to separate from the railroad property the large investment holdings of the Company in other enterprises. Some preferred shareholders have claimed a right to participate in such distribution. A similar difficulty may occur in case the Reading Company is compelled to dispose of its coal properties. In this instance, however, the Reading can exercise the redemption privilege.

A further complication may arise because of the division of voting control. Not all preferred shares have a voting right. When the voting power is given, in some instances it has been threatened with nullification by the exercise of the redemption privilege. When the preferred stock has equal voting

rights with the common and cannot be retired, the administrative control will rest with the class of stock having the largest number of shares outstanding. This naturally leads the controlling class to favor a policy which adds to the intrinsic value of its own shares rather than to the capital stock as a whole. An instance of this kind is the controversy among the St. Joseph & Grand Island stockholders. The Union Pacific Railroad, having obtained a majority of common shares, acquired administrative control. One result of this was the cutting of the dividends that had previously been paid on the St. Joseph & Grand Island Preferred Stock. Surplus earnings of the company were applied to new railroad construction. Some of the preferred stockholders naturally felt aggrieved and brought suit to enjoin the Union Pacific from voting its shares at the stockholders' meetings. A way out of the controversy is sought through an offer of the Union Pacific to buy up at a stipulated price the stock of dissatisfied shareholders.

Significant provisions, designed to prevent possible neglect of preferred stockholders' interests, are attached to some issues of preferred stock. The Rock Island Company's preferred stockholders, for example, are entitled to elect a majority of the directors. The Wisconsin Central's preferred stockholders have a similar right whenever the company has failed for a period of two successive years to pay the prescribed maximum preferred dividend. A more common provision is the requirement of

the consent of two-thirds or more of the preferred stockholders to an authorized increase in the amount of preferred shares. In some instances, consent is also required for the authorization of an increase in funded indebtedness. Increased capitalization, through the issue of securities having prior or equal claim upon earnings and assets, naturally affects the securities already outstanding. Consequently, it is only proper that provisions should be made to safeguard the interests of each class of security holder.

It would be interesting, if space permitted, to give further examples of the rights and priorities of different issues of railroad preferred stocks. Sufficient has been told, however, to show that the general principle is the same in most cases. In brief, the holders have preference as to assets or to profits or both, and they also may have a veto upon the creation of mortgages or additional preferred shares.

Common Stock. Common shares comprise by far the largest part of railroad capital stock. American railroad companies when first organized had only common shares, whereas, at the present time but one railroad, viz., the Great Northern, has issued only preferred shares.[1] The Pennsylvania Railroad, the New York Central & Hudson River, the Illinois Central, the Lehigh Valley and the Delaware, Lackawanna & Western, the Louisville & Nashville,

[1] Because the charter of the Great Northern Railroad authorized an issue of as much preferred stock as the Company deemed proper, the Company in 1898 surrendered all right to issue common stock. The Great Northern stock is now "of a single class with uniform rights and privileges."

and a host of other standard American railroad organizations with an unbroken and successful history have but one class of capital stock outstanding. Thus, the shareholders of these companies all have the same rights and privileges; they receive profits or other distributions in accordance with the number of shares held by each.

The common shareholders are the "residual claimants" to surplus earnings. Having no claim to a stipulated return, they share in profits only after all other charges have been met. Except when limited by law, there are no restrictions on the possible dividend rate on the common stock shares. For this reason common stock frequently has what is termed a speculative value. This means that the par value as measured by market price is not based on the actual rate of dividend received, but on the probability of increase or decrease in this rate. Thus, when New York Central shares, paying 5 per cent. dividends sell at a price giving 4.4 per cent. on the investment, Chesapeake & Ohio paying the same rate gives 6.3 per cent. Baltimore & Ohio and Pennsylvania both distribute 6 per cent. annually to shareholders, but on the same day according to stock market quotations, the investment yield on Pennsylvania is 4.8 per cent. and on Baltimore & Ohio 5.6 per cent. Louisville & Nashville stock paying 7 per cent. dividends offers investors 4.4 per cent. when the Northern Pacific, which also pays 7 per cent. offers 5.6 per cent. When one stock offers a great deal more to investors than others, all other

circumstances being equal, it means either a larger dividend rate or larger actual or probable surplus earnings available for dividends.

The rights of common shareholders do not imply a full *pro rata* distribution of each year's surplus profits available for these shares. As in the case of non-cumulative preferred stock, the payment and the rate of dividend is dependent on the action of the company's directors. Acting as the administrative body, directors may decide to withhold the surplus earnings in whole or in part from the stockholders.

The investment value of railroad shares is not alone dependent on the annual dividend return received. Occasionally stockholders receive extra dividends, or bonuses. They may also receive the "right" to subscribe for new issues of stock below the prevailing market price. These "rights" are negotiable. If the shareholder does not wish to purchase the new stock alloted to him he can transfer the "right" to another party. The "rights," therefore, generally have a market value and can be converted into cash. Accordingly they do not differ materially from extra cash dividends. Preferred shareholders, and in rare instances, certain classes of bondholders, may be granted participation in "rights."

Extra dividend distributions or bonuses, whether in cash or in new stock are familiarly referred to as "melon cutting." Stock bonuses theoretically represent a reward to common stockholders for the withholding from them of the surplus earnings available

for dividend distribution. In other words, the company, by granting a stock dividend, may simply be returning a loan "forced" from shareholders. This is known as the "capitalization of surplus." This method of obtaining capital is good financial policy as long as it is less expensive to the railroad company than borrowing from the public.[1]

Railroad Funded Indebtedness. *Funded Indebtedness*, as defined in railroad finance, comprises all negotiable instruments of credit having a maturity period of one year or more. These form a part of railroad capitalization, whereas, indebtedness in the form of certificates without fixed maturity dates or of a maturity period of less than one year, is *Current Indebtedness* and is not included in the aggregate of railroad capitalization. This distinction between *Funded or Capital Indebtedness* and *Current Indebtedness* is theoretical and arbitrary. It is, nevertheless, useful in comparative analyses of railroad capitalization and in the compilation of capitalization statistics.

The holders of railroad obligations, in their capacity as creditors, generally have no voice in the administration of their debtor companies. There are a few exceptions, however. The holders of two classes of Erie Railroad bonds—(the Prior Lien and the General Lien Bonds)—aggregating approximately $84,000,000, have proportionately equal voting rights with the $176,271,300 par value of stock. The Consolidated Sinking Fund Bonds of the Chi-

[1] This subject is considered further in Chapter XII.

cago and North Western Railroad, due February 1st, 1915, also carry the voting privilege.

Classes of Funded Indebtedness. *Bonds*: Railroad funded indebtedness is usually classed under two general headings, *Bonds* and *Notes*. These, however, are only distinguished by period of maturity. *Bonds*, as a rule, have a maturity period of ten years or more, whereas, *Notes* mature in from one to ten years.

Railroad bonds are of various kinds. In general they may be classified as:

(1) Mortgage Bonds
(2) Collateral Trust Bonds
(3) Convertible Bonds
(4) Plain Bonds or Debentures
(5) Income Bonds.

This classification is not intended to mean that each railroad bond may be definitely assigned to one class and excluded from the others. Some issues have the attributes of two or more classes. Thus, a *mortgage* bond may also be a *collateral trust* bond, and a *convertible* bond may be either a *mortgage* bond or a *plain* bond (*debenture*). A *mortgage* bond, or a *collateral* bond, however, cannot be a *plain* bond. This will be made clear in the description of each of the groups in the classification.

Railroad Mortgage Bonds. This class of railroad bonds, as the name implies, is an obligation secured by a mortgage or lien on the whole or some part of the debtor company's property. They thus resemble a negotiable real estate loan for which the real estate is

pledged as security. In the case of bonds, however, the loan is generally distributed among a large number of holders, who cannot assert their claim against the debtor corporation individually and independently. They must act jointly for the equitable interests of all and through the medium of a trustee.

The rights and equities of the mortgage bondholder are contained in a written instrument known as the *Deed of Trust, Indenture,* or *Mortgage.* Every holder of any class of bond, if he wishes to know the exact nature of his security must consult the deed of trust. This legal document is a contract between the railroad issuing the bonds and a trustee acting for and in the name of the bondholders. The trustee is generally a trust company or a banking house. Individuals may also act in this capacity.

Under the terms of the deed of trust the railroad company conveys and assigns unto the trustee all of the property, franchises and other possessions upon which the bonds are to be a mortgage. The deed also specifies the amount of bonds, and the conditions under which they may be issued. It contains, moreover, a description of the property to be mortgaged so that it may be readily identified. There are also provisions that the property is to be kept insured and in repair, and there may be also other important stipulations designed to protect the bondholders. It is usually specified that if default is made in the performance of any agreement contained in the deed of trust, such as the failure to pay interest upon the

outstanding bonds, the whole amount of the principal then becomes due and payable. The consent of the holders of a specified majority of the bonds is usually required to determine whether the mortgaged property is to be sold or disposed of for their benefit as creditors.

Railroad mortgage bonds usually bear a fixed rate of interest and mature after a definite period. The company, however, may have the option of retiring a part or all of the bonds of an issue at a stipulated price before maturity date. Usually the railroad property upon which the bond is a lien consists of a certain portion of roadbed and track. In this way the bondholder may determine the relation of the face value of the bonds to the length of mortgaged mileage. For example, if $10,000,000 of the bond issue is outstanding and the length of the railroad property mortgaged is 250 miles, the issue is at the rate of $40,000 per mile, provided there are no prior liens. Whether this rate is high or low depends, among other things, on the actual cost of the property, its permanency and its earning capacity. Of course, the mortgage may cover other and more costly property than the roadbed and track. This factor, along with many others, should be determined in estimating the value of mortgage bonds.

The mortgage bonds are variously named as Prior Lien, First Mortgage, Second Mortgage, General Mortgage, Refunding Mortgage, etc. A single issue may have a combination of two or more of these adjectives. The theoretical distinction between a

first and second mortgage is readily understood. The public, however, may be misled through the names of some bond issues. Thus, the Toledo, St. Louis & Western Railroad has a 3½ per cent. Prior Lien Bond issue of $9,500,000 and a 4 per cent. First Mortgage Bond issue of $6,500,000. The latter, however, constitutes an inferior mortgage on the property securing the Prior Lien Bonds. A similar deception may arise from the name "First and Refunding Mortgage." In this instance the issue may constitute a *first* mortgage on a very small part of the property and a *secondary or inferior lien* on the remainder. Thus, the Denver & Rio Grande Railroad authorized an issue of $150,000,000 of First and Refunding 5 per cent. Gold Bonds. On June 30, 1912, there were $33,944,000 of these outstanding. They then constituted a first mortgage on but 129 miles of railroad and an inferior lien (subject to prior liens of $82,500,000) on 2,400 miles. Evidently, there was very little basis for the term "First Mortgage" at the time of issue.

On many of the large railroads a distinction exists between *General Mortgages* and *Divisional Mortgages*. The lien of the divisional mortgage is localized, covering the property of a branch line or division, whereas, the general mortgage usually covers, subject to prior liens if any, the property as a whole. For various reasons, a divisional mortgage, other things being equal, has not the intrinsic merits of a mortgage covering the main property of a railroad company. This arises chiefly from the fact that a

division or branch of a large railroad system is not an independent transportation unit. Its value and its earning power are dependent on the affiliation with the main lines of the railroad.

Collateral Trust Bonds. These differ in one essential particular from mortgage bonds. In place of physical property they are secured by a pledge of securities deposited with a trustee. Collateral trust bonds, therefore, may be an indirect first lien on property through the pledging of first mortgage bonds as security. When stocks are pledged as collateral, there is a lien upon the equities represented by this class of securities. Frequently two or more classes of securities are pledged for one issue of collateral trust bonds. In addition, a direct lien may be granted on physical property as further security. Thus a collateral trust bond may be partly a mortgage bond, just as a mortgage bond may be partly secured by pledge of securities as collateral. Collateral trust bonds are issued under a deed of trust similar to that of mortgage bonds. The pledged securities are conveyed "in trust" to a trustee, with whom they are generally deposited. As long as there is no default in the interest or principal on any of the collateral bonds, the railroad owning the pledged securities is entitled to all the income accruing from such ownership. The railroad company may also be given the privilege, subject to the sanction of the trustee, to substitute other securities for any or all of those pledged. These and other rights and privileges are usually defined in the deed of trust.

In every case the terms of the contract should be known and understood by those who wish to invest in collateral trust bonds.

The investment value of collateral trust bonds depends, first, upon the character and intrinsic value of the pledged securities and, secondly, upon the general credit and financial standing of the company pledging the security. As a rule, the terms under which collateral trust bonds are issued require a guarantee on the part of the issuing company to pay both interest and principal, regardless of whether or not the pledged securities can be sold or otherwise disposed of at the stipulated redemption price of the collateral bonds. Every precaution, however, is desirable to maintain the intrinsic value of the collateral. An example of how this can be done is furnished by clauses in the deed of trust of the Atlantic Coast Line Collateral Trust 4 per cent. Gold Bonds. This issue was originally secured by $35,000,000 of Louisville & Nashville Railroad stock. Since the collateral constitutes a majority stock ownership and controlling interest in the Louisville & Nashville Railroad, precautions are taken that this controlling interest shall not be impaired. The Atlantic Coast Line, therefore, covenants that whenever the Louisville & Nashville issues additional stock the same proportion of the new stock as of the Louisville & Nashville's old stock already held shall be deposited as further collateral for the bond issue. Moreover, the Atlantic Coast Line in the exercise of its ad-

ministrative control over the Louisville & Nashville agrees

"that it will cause all repairs, renewals and replacements, necessary to maintain the railroads, structures, locomotives, cars and other equipment, tools and other property of the Louisville & Nashville Company in their present good order and condition, to be made out of the earnings of said railroads and other property."

There are additional clauses in collateral trust indentures having the purpose of preserving the equity and value of the stock or other securities pledged as collateral.

Convertible Bonds. This class of bonds existed in the early days of railroad construction, but has come into prominence only in the past few years. Similar to other railroad bonds they are a direct obligation of the issuing company, maturing in a certain period of time, and bearing a fixed rate of interest. In addition, however, they carry the privilege to the holders of exchanging them for a class of capital stock of the debtor company under prescribed terms and conditions. This convertibility gives the bonds a speculative value, which causes their market price to fluctuate within certain limits in accordance with the market price of the stock into which they may be converted. The conversion is arranged at a fixed rate. It may be \$100 par value bonds for one \$100 share of stock, or it may be \$125 of bonds for one share of stock. Since railroads are not generally permitted to issue stock under par value the conversion figure is rarely at less than one \$100 share of stock for \$100 of bonds. The Erie Railroad, however,

has a bond issue which is convertible into the common stock of the company at $100 in stock for $60 in bonds.

The holder of a convertible bond, in addition to an assured rate of return on the bond, has an opportunity to benefit in the railroad's financial progress. The value of the bond tends to appreciate with the value of the stock. If the bonds sell above the conversion figure but below the price of the stock an intending purchaser of the stock will save by buying the bonds and converting them into stock. If, however, the stock is selling below the conversion figure price fluctuations in the stock up to this point do not necessarily affect the price of the bond. The bonds may then retain a higher market value than the stock since this market value will be based on the rate of interest and the security attached to the bond.

As a rule convertible bonds are not a direct lien on any property. There are exceptions, however. In 1909, the Missouri Pacific issued $29,800,000 of Convertible First & Refunding Mortgage 5 per cent. Bonds, Series A, which are convertible dollar for dollar into stock, at option of holder, from September 1, 1912, to September 1, 1932.

In a number of convertible issues the equity of the holders is safeguarded by a provision which requires that in the event of the company creating a new mortgage on its property, except for refunding purposes, the convertible bonds are to be equally secured thereby. In 1910, stockholders of the

Chesapeake & Ohio authorized an issue of $37,000,000 of 4½ per cent. convertible bonds with a provision of this kind. The next year, a new mortgage was authorized to secure an issue of not exceeding $125,000,000 of 5 per cent. 20 year gold bonds. Accordingly, under the terms of this mortgage the 4½ per cent. Convertible Bonds are on a parity with the new mortgage bonds in respect to all liens on property owned by the railroad company April 28, 1910, the date of the issue of the convertible bonds.

Plain Bonds, or Debentures, as they are called, are without the mortgage feature. They are obligations issued on the faith and credit of the company. No specific property or franchises are pledged for their security. Because of the absence of a definite pledge of property, debentures are issued and sold mainly by the richest and strongest of the railroad companies. American investors appear to demand the assurance of a lien or some countervailing feature, which in case of default or bankruptcy will give them a preference among general creditors. This demand is fostered by State laws which prohibit insurance companies, savings banks and similar institutions from investing in any other railroad bonds than mortgage bonds. Debenture bonds may occasionally become mortgage bonds because of an agreement of the issuing company not to place a new mortgage upon its lines unless the debentures are also secured thereunder. Thus, the New York Central & Hudson River Railroad authorized $50,000,000 of 4 per cent. debentures which are

issued with the agreement that so long as any of these bonds remain outstanding the Company will not place any new mortgage upon its property without also including therein all outstanding debentures of this issue. This agreement, however, does not prevent renewal or extension of any existing mortgage. Similarly, the several issues of debentures of the Atchison, Topeka & Santa Fé Railroad (including those convertible into stock) must be secured by any future mortgage covering the lines owned by the railroad at the time the debenture issue was made. Provisions of this kind tend to safeguard the equities of plain bonds.

Income Bonds. This class of bonds form but a very small portion of railroad funded obligations. They are usually known as "adjustment" bonds, from the fact that they are generally created at reorganizations in which a financial adjustment is accomplished by reduction in fixed charges. Holders of second or junior lien bonds may then be permitted to exchange their holdings for income bonds. Unlike other classes of bonds, "incomes" do not have a claim to an interest return from the issuing company unless earnings are available for this purpose. These bonds, therefore, as a claimant of profits are in much the same position as preferred stock. There is one essential difference, however. When the interest on income bonds is earned by the issuing company it must be paid. The directors have no discretion in the matter. This is not the case with preferred stock dividends. Even when earned by

the company, the directors have the privilege of withholding payments. Income bonds may have the cumulative feature. This prohibits the payment of any dividends on capital stock until all arrearages in interest on the income bonds have been made up. The Seaboard Air Line Adjustment Mortgage Bonds, for example, are entitled to cumulative interest at 5 per cent. to be payable as earned in installments of 1¼ per cent. or multiples thereof. No dividends are to be paid on Seaboard Air Line stock until all overdue interest on these bonds is paid in full. The Central of Georgia Railroad Income Bonds have not this cumulative feature. This resulted in the loss to the holders of the full 5 per cent. interest for a number of years. Dissatisfaction on the part of the holders, claiming that the full interest on the bonds was earned but withheld, led to litigation. The final outcome was an offer by the Illinois Central Railroad (the owner of the Central of Georgia's capital stock) to purchase the income bonds at a fixed price.

Railroad Short Term Securities. *Notes:* Railroad notes do not differ essentially from bonds. They are secured in the same way and may be *mortgage notes, collateral trust notes* or *debenture notes.* Their denomination is, with few exceptions, the same as bonds, *i. e.,* in $500, $1,000 or multiples thereof. The only distinction between notes and bonds, as already pointed out, lies in the period of maturity. In railroad finance a short term obligation or "note" may run from one to ten years. Obligations issued to mature in a longer period are generally designated

as bonds. Frequently notes are issued to mature serially. This means that a certain proportion is to be "called" (*i. e.*, redeemed), at specified intervals, and each note of a total issue bears its maturity date.

A popular kind of railroad serial note is the *Equipment Trust Certificate.* This is secured by a lien on certain railroad rolling equipment, either locomotives or cars, or both. Since the equipment, through use, gradually depreciates and is finally "scrapped," the aim is to maintain the equity value of the certificates by having a portion of them mature each year. The longest maturity does not exceed the estimated period of usefulness of the equipment. According to Interstate Commerce Commission statistics, there were outstanding June 30, 1912, $318,182,259 of railroad equipment obligations. Among these are the obligations of railroads enjoying the highest reputation for financial soundness.

Railroad notes are generally regarded as temporary means of financing. As a rule they are replaced at or before maturity by long term obligations. It is frequently the practice to deposit with a trustee the securities which are to replace the notes so that these may serve as collateral. When the credit of the issuing company, or the general condition of the money market warrants, the pledged bonds may be sold and the notes paid off with the proceeds. Thus, a railroad company generally reserves the privilege of "calling in" the notes before maturity. The redemption price is stipulated in the indenture under which the notes are issued.

CHAPTER III

RAILROAD SYSTEMS OF THE UNITED STATES

Development of Railroad Systems. The individual lines comprising the vast net work of American railroads for the most part can be conveniently grouped in accordance with system organization and geographical location. This arises from the fact that railroad expansion followed along the important channels of trade between great centers of traffic. A number of ill-defined geographical zones were gradually established, each comprising a region of large traffic interchange. These regions marked the territorial limits of many of the great railroads and became the basis of regional freight rate structures.[1] Thus, in the early years of American rail transportation, the aim was to connect the Atlantic ports with the Great Lakes and with the Ohio and Mississippi River settlements. The pioneer American railroad enterprise, *The Baltimore & Ohio Railroad*, as its name implies was built to handle the traffic interchange which had formerly passed by turnpike between the tide-water sections of the East to the fertile region beyond the Alleghenies. The proposed construction of the Erie Railroad by the State of New York in the early thirties had the paramount

[1] See McPherson, "Railroad Freight Rates," etc., Chapter VII.

object of facilitating and promoting the intercourse between the metropolis of the State and the Lake Erie ports.

In course of time, railroad development advanced sufficiently to permit through shipments from one extreme of the natural geographical divisions to another. The railroad companies whose lines afforded this continuous transportation came to be known as *trunk lines.* This distinguishes them from *local lines* which serve only intermediate sections and which must interchange their long haul shipments with other lines. Thus, a *trunk line* may be defined as a railroad whose principal tonnage originates and moves on its own lines between two great points of traffic interchange. As regards traffic movement, therefore, a *trunk line* is, relatively speaking, an independent organic unit. It is not dependent on other companies either to receive or to furnish the bulk of its "through" shipments. Of course, these distinctions are relative and are influenced by traffic conditions. There are railroads which are neither *trunk lines* nor *local lines.* Chief among these are the roads which haul some important commodity, such as coal or ore, from the point of origin to a primary market. The Philadelphia & Reading, the Lehigh Valley and other leading "coalers" are certainly not *local lines.*

The application of the term *trunk line* naturally varies as the distance between principal centers of traffic interchange increases. Originally, the individual trunk lines of the East had their termini

in the principal Atlantic ports at one end and in Pittsburgh, Buffalo or other points just beyond the Alleghenies, at the other end. The development of the region beyond the Ohio and the Mississippi, and the growth of traffic centers such as Cincinnati, St. Louis and Chicago, increased the traffic interchange between tide-water and these points. The leading railroads extended their lines in conformity with this trend. This was not generally accomplished by the actual construction of new extensions. Local and connecting roads had already been built to the more distinct localities. Consequently, the old established companies, in order to expand their lines so as to retain the through traffic, acquired by merger, by purchase or by other means the lines already furnishing connections with the desired localities. In this way, *railroad systems* developed. An individual railroad company is no longer the type of a definite or complete transportation unit. A combination or series of lines, affording, together, through routes between distant centers of commercial intercourse is the present enlarged type of a railroad organization. This development has taken place in all geographical divisions of the United States. The progress of territorial unification of transportation companies is constantly reducing the number of different railroad company securities dealt in currently on the public stock exchanges. Investment interest centers largely in the "*parent*" *companies* that have acquired a "system" of lines to the exclusion of the *subsidiary* companies that have

been brought under the "system" control. The latter are merely "*subsidiaries*," whose welfare is bound up with the affairs of the parent corporation.

Why have the railroads expanded in order to obtain as large a share of through traffic as possible? The answer is that the whole profit remains with a railroad when a shipment is made over its own lines from point of origin to place of destination. Other railroads participate in the profits when the through service is performed in conjunction with independent and outside lines. The Lehigh Valley Railroad, for example, begins at New York and ends at Buffalo. It receives freight at New York consigned to Chicago and other points west of Buffalo. At Buffalo, it must turn over these shipments to some other railroad system. In this instance, let us assume, the connecting line is the Grand Trunk Railway. The latter conveys the freight as far as Detroit, whence the shipments destined further west are forwarded by a third company. This is an example of "through routing" involving the participation of two or more independent railroad organizations. The apportionment among them of the revenue received from each shipment is the result of "prorating." To "prorate" is to join with another railroad in making a through rate for a haul which covers parts of both lines. This rate is almost invariably less than the sum of the local rates between the same points. Now, it is very probable, because of the lower proportionate rate for "through" or "long haul" traffic that the Lehigh Valley, as its share of the revenue, does not receive

as large an amount as it would have received if all shipments were consigned to its western terminus. The service performed, however, is the same in either case. It is, therefore, to the interest of railroad companies desiring to gain the full benefit of "through" or "long haul" business to acquire a system of lines which, in combination, will cover the points of origin and destination of the bulk of its traffic. This factor should be fully considered in estimating the traffic features of individual railroad companies.

It is thus evident, from what has been said in the foregoing pages, that the railroad systems of the United States have developed both through extension of corporate lines and through annexation and affiliation of independent connecting roads., As the result of this unification more than two-thirds of the steam railroad mileage in the United States can be grouped under less than twenty-five systems, each with a centralized administrative control. The systems in the order of their mileage, according to *Interstate Commerce Commission classification* at present writing are as follows:

System	*Miles*	*System*	*Miles*
New York Central	13,342	Chicago & North Western	9,845
Chicago, Burlington & Quincy	11,779	Southern Railway	9,836
Atlantic Coast Line [1]	11,560	Chicago, Milwaukee & St. Paul	9,737
Pennsylvania	11,198	Illinois Central	8,248
Atchison, Topeka & Sante Fé	10,601	Rock Island	8,158
Southern Pacific	10,255	St. Louis & San Francisco	7,525

[1] Includes the Louisville & Nashville System.

System	*Miles*	*System*	*Miles*
Union Pacific	7,383	Denver & Rio Grande	3,719
Missouri Pacific	7,279	Missouri, Kansas & Texas	3,665
Great Northern	7,113	Seaboard Air Line	3,091
New York, N. H. & Hartford	6,667	Wabash	3,085
Northern Pacific	6,306	Erie	2,567
Baltimore & Ohio	5,569	Chesapeake and Ohio	2,579
Canadian Pacific (in U. S.)	4,768	Reading	2,171

The foregoing list of the leading railroad systems does not imply that each is operated independently without affiliation or relationship with other systems. There is a unity of administrative control among several of the systems. The Union Pacific through part ownership of the Southern Pacific Company until 1913 controlled the financial policy and the operations of the Southern Pacific System. The Great Northern and the Northern Pacific Systems, besides being affiliated through personal control of the same financial interests have a joint control of the Chicago, Burlington & Quincy System. The Missouri Pacific, the Denver and Rio Grande, and the Wabash systems are also affiliated largely through the personal influence of the same financial interests. Together, from an administrative viewpoint, they may be defined as a railroad system.

Thus, the system of grouping of railroads in the United States may be on the basis of administrative rather than traffic control. This administrative control may be lodged with individuals or with corporations, or with both jointly, as shown in the following list:

Systems

J. J. Hill Group
- Great Northern
- Northern Pacific
- Chicago, Burlington & Quincy

E. W. Harriman Group
- Union Pacific
- Southern Pacific [1]
- Illinois Central
- Central of Georgia

Pennsylvania Group
- Pennsylvania Lines
- Norfolk & Western

Vanderbilt Group
- New York Central Lines
- Reading (jointly with Baltimore & Ohio)
- Chicago & North Western System

Atlantic Coast Line (Walters) Group
- Atlantic Coast Line
- Louisville & Nashville

Missouri Pacific (Gould) Group
- Missouri Pacific
- Wabash
- Denver & Rio Grande
- Texas & Pacific
- International & Great Northern

E. H. Hawley Group
- Toledo, St. Louis & Western
- Minneapolis & St. Louis
- Chesapeake & Ohio
- Missouri, Kansas & Texas

[1] The segregation of Union Pacific Railroad's holdings of Southern Pacific stock, in accordance with Supreme Court decree, may result in the separation of the latter system from this group.

J. P. Morgan Group
- New York, New Haven and Hartford
- Erie
- Southern Railway
- Chicago Great Western
- Pere Marquette

The Moore-Reed Group
- Rock Island
- Lehigh Valley

The progress of unification in railroad control is well indicated in the above grouping. In fact, of the entire steam railroad mileage of the United States, less than one-fourth may be termed independent. This situation is of particular significance to shippers and to investors. The character and resources of the administrative control of any business enterprise are fundamental elements of its investment value. Profitable and satisfactory railroad operation requires sound financial policy and efficient management. Satisfactory facilities for obtaining credit must also be at hand. This means that strong banking interests capable of procuring necessary capital funds are to be represented in the management. One of the conditions assisting in the absorption of many local lines by large railroad systems has been the inability of the independent companies to obtain with their own resources proper banking support.[1]

Methods of System Unification. The means of uniting separate railroad corporations into a system

[1] See "Railroad Changes and their Relation to Credit," by Charles F. Speare, in *Moody's Magazine*, April, 1909.

are various. The original method was through corporate merger. This was the plan followed by the New York Central when it consolidated some sixteen local lines operating between Albany and Buffalo. Legal restrictions and failure to satisfy dissenting shareholders have now rendered corporate consolidations exceedingly difficult. An example is afforded in the New York Central & Hudson River Railroad's endeavor to merge the New York & Harlem River Railroad with its own corporate lines. Though the shareholders of the latter have been offered $175, for each share ($50 par value) of stock, a substantial minority at this writing is holding out for better terms. A further practical difficulty against mergers is the heavy capital outlay involved. When administrative control can be obtained through the acquisition of a substantial part (usually 51 per cent.) of the capital stock, the purpose of unification in most cases is gained as well as through complete merger. The investment outlay of the purchasing company, however, is very much less. Herein lies one of the chief reasons why railroad unification in the United States has taken the form of majority stock ownership. It has led to the creation of two distinct railroad administrative activities; one, consisting of the transportation operations of lines directly operated, the other relating to investments represented by stockholdings in subsidiary and affiliated companies. Thus, there are railroads which are in part "*holding companies*" and in part, "*operating companies*." The importance of distinguishing

between these activities of railroad organizations cannot be too highly emphasized.

There are a few instances where the administrative control is lodged with a "*holding company*" operating no railroad mileage under its corporate name. The Reading Company is a type. This Company was organized in 1896 for the purposes of acquiring the Philadelphia & Reading Railroad Company and the Philadelphia Coal & Iron Company. Later, it acquired 53 per cent. of the capital stock of the Central Railroad of New Jersey. In addition to these large holdings, the Reading Company has miscellaneous holdings in street railways, navigation and mining companies. But the Reading Company, itself, is controlled jointly by the New York Central and the Baltimore & Ohio Systems, each of which owns 21.7 per cent. of its $140,000,000 capital stock.

The Rock Island Company, whose shares are dealt in on the stock exchanges, is another railroad "holding company." It owns the entire capital stock ($145,000,000) of the Chicago & Rock Island *Railroad* Company which, in turn, owns 93 per cent. of the capital stock of the Chicago, Rock Island Pacific *Railway* Company. The *Southern Pacific Company* is a holding company of very much broader scope than the Rock Island and Reading companies. Organized under the laws of Kentucky, the Southern Pacific Company has acquired the capital stock of a whole group of separate railroad organizations, chief among which are the Southern Pacific Railroad

and the Central Pacific Railroad. The totally owned roads are called the *Proprietary Companies.* Others whose capital stock is only partially held, are designated *Affiliated Companies.* The different organizations in the Southern Pacific System June 30, 1912, comprise the following:

Southern Pacific Company

(1) *Controlled; also leased*	*Miles*
Central Pacific Ry.	2,079
South Pacific Coast Ry.	97
Southern Pacific R. R.	3,501
Oregon & California R. R.	685
New Mexico & Arizona R. R.	88
Sonora Ry.	264
(2) *Controlled by Southern Pacific Company—Operated by Companies owning them*	
Galveston, Harrisburg & San Antonio Ry.	1,338
Houston & Texas Central R. R.	789
Louisiana Western R. R.	207
Morgan's Louisiana & Texas R. R. & S. S.	404
Texas & New Orleans R. R.	452
Houston & Shreveport R. R.	40
Houston E. & W. Texas Ry.	191
Southern Pacific Co.	27
(3) *Controlled by Morgan's Louisiana & Texas R. R. & S. Co.*	
Iberia & Vermillion R. R.	16
Total	10,114
Steamship Lines	4,810
Other Proprietary Companies—	
Arizona Eastern	364
Southern Pacific R. R. of Mexico	949
Coos Bay, Roseburg & Eastern	27
Corvallis & Eastern	146
Grand total of owned, leased and affiliated lines June 30, 1912	11,600

The Pennsylvania *Company* is another example of unification of a group of separately incorporated lines through a "holding company." This corporation was chartered as far back as 1870 with a capital stock of $70,000,000 all owned by the Pennsylvania *Railroad* Company. Although holding no mileage in fee, the Pennsylvania company operated or controlled, on January 1, 1913, railroad lines aggregating 5,105 miles of road, constituting the Pennsylvania Railroad System west of Pittsburgh.

In addition to unification acquired through consolidation and stock control, railroad system expansion has been accomplished through lease of separately incorporated properties. In many instances, the companies having leasehold also have a controlling interest in the capital stock of the leased corporation. Under whatever arrangement the leased lines are held they are in every case a part of *directly operated mileage* of the lessee and are included under the reports of the lessee's operating results. When the leasehold covers a very long or indefinite period, as 99 years or more, the leased line is to all intents and purposes a part of the lessee's corporate property. One important distinction, however, requires consideration. A leasehold ordinarily involves no capital outlay or readjustment of capitalization. There is no value representing the lease among assets or liabilities. Hence, the leasing of independent lines is the simplest method of extending railroad system mileage. For this reason it has been followed extensively from early railroad times.

The New York Central & Hudson River Railroad offers one of the best examples of the expansion of mileage through lease of connecting lines. On January 1st, 1913, it owned in fee 806 miles, whereas, its mileage operated under lease and trackage rights aggregated 2,985. This does not include the controlled mileage operated by subsidiary companies. The Pennsylvania Railroad Company likewise operates a large mileage under lease or contract. Of a total of 4,025 miles directly operated, on January 1st, 1913, 2,128 miles were owned in fee, and the remaining 1,897 miles were operated under lease and under trackage rights.[1]

Geographical Location of Railroad Systems. The preceding paragraphs have shown the development of railroad unification and system organization and control. It is our purpose now to classify and briefly describe the principal systems in accordance with their geographical zones. Although the terminal demarcations of railroad system development have corresponded with the familiar geographical divisions of the country, extensions and overlappings into sections beyond the zones of the main lines render a classification based on territorial boundaries exceedingly difficult. However, the following system classification will be found of service in studying railroads with respect to location and to traffic characteristics:

[1] *Trackage Rights* constitute the privilege obtained through contract to run trains over the tracks of another company.

Group I. NEW ENGLAND SYSTEMS

The New York, New Haven & Hartford Lines

Group II. EASTERN TRUNK LINE SYSTEMS

The New York Central System
Pennsylvania Railroad System
Erie System
Baltimore & Ohio System
Chesapeake & Ohio System

Group III. ANTHRACITE SYSTEMS

Reading System
Delaware, Lackawanna & Western R. R.
Lehigh Valley Railroad
Delaware & Hudson Company
New York, Ontario & Western R. R.

Group. IV SOUTHERN SYSTEMS

Southern Railway System
Atlantic Coast Line System
Seaboard Air Line System

Group V. MISSISSIPPI VALLEY SYSTEMS

Illinois Central System
Louisville & Nashville System
St. Louis & San Francisco System
Missouri, Kansas & Texas R. R.
Kansas City Southern Railway

Group VI. MIDDLE WESTERN SYSTEMS IN THE NORTH

Wabash System
Toledo, St. Louis & Western
Pere Marquette R. R.

Group VII. NORTHWESTERN SYSTEMS

Chicago & North Western System
Chicago, Milwaukee & St. Paul System

Group VII. Northwestern Systems.—*Continued*

Chicago, Burlington & Quincy System
Union Pacific Lines
Northern Pacific Lines
Great Northern Railway
Minneapolis, St. Paul & Sault Ste Marie
(Canadian Pacific in U. S.)

Group VIII. Southwestern Systems

Southern Pacific System
Atchison System
Missouri Pacific System
Rock Island System

The foregoing list comprises only the important railroad systems in the United States. There is no claim of completeness. A number of independent railroad companies whose securities are actively dealt in are operated without a "system" administrative control. In view of the unification movement, however, these continuously tend to be reduced in importance. One of the causes retarding the merging of independent lines with existing systems is the Sherman Anti-Trust Act. This law is applied to railroads as prohibiting identical control of parallel and competing lines. Thus, the Pennsylvania Railroad Company, after the Supreme Court's Northern Securities Decision, relinquished its control over the Baltimore & Ohio Railroad by disposing of one-half of its holdings in that company. More recently the Union Pacific was compelled to segregate its holdings of Southern Pacific stock on the ground that this ownership constituted a restraint of trade.

I. New England Systems: *The New York, New Haven & Hartford* is the only great railroad system that has its principal situs in New England. In its control over New England rail transportation it is far ahead of other interests. The leading lines embraced within its system organization (exclusive of electric railways and steamship companies) on June 30, 1912, was as follows:

Road	*Location*	*Miles*
New York, New Haven & Hartford ...	Southern New England..	2,042
Boston & Maine [1]..................	Central & Northern New England.............	2,290
Maine Central (Controlled by Boston & Maine)........................	Maine.................	1,164
New York, Ontario & Western	New York City to Oswego on Lake Ontario.	566

In addition to the above controlled lines and other smaller connecting companies, the New York, New Haven & Hartford has trackage rights, terminable at one year's notice, over the Boston & Albany, a leased line of the New York Central System. It also controls, jointly with the New York Central, the Rutland Railroad (468 miles) traversing Vermont and Northeastern New York.

II. The Eastern Trunk Line Systems. These lines form the rail connections between the Eastern seaboard ports and the Western traffic centers, St. Louis and Chicago. Their long haul business is very competitive. The large traffic handled, however, gives them a high average earning power. More-

[1] Controlled through majority stock control of the Boston Holding Company.

over, because of heavy business, their lines from an engineering standpoint, are required to be of the most modern and expensive kind. The large industrial and densely populated sections traversed have fostered the development of numerous branches. These are traffic "feeders," augmenting both the long and the short haul business.

The Pennsylvania System. The growth of the Pennsylvania System began about 1850. A quarter of century later when lines had been extended beyond the Alleghenies its mileage was approximately 4,000 miles. The Pennsylvania System lines now extend from New York, Philadelphia and Baltimore, in the East, to Buffalo and the Lake Erie ports in the North, and to Cincinnati, St. Louis and Chicago in the West. Numerous branches and feeders connect with almost all intermediate centers of industry in this region. The total mileage of the system on January 1, 1912, is represented as follows:

PENNSYLVANIA RAILROAD SYSTEM

East of Pittsburgh & Erie	*Miles*	*West of Pittsburgh & Erie*	*Miles*
Owned in fee	2,128	Pennsylvania Co. Lines	1,680
Operated by Lease or Contract	1,749	Pittsburgh, Cincinnati, Chicago & St. Louis	1,418
Trackage	234	Other Controlled Companies	2,079
Operated by Separate Organizations	2,219		
Total	6,330	Total	5,177

Grand Total, January 1, 1912, 11,504 miles.

In addition to the foregoing, the Pennsylvania Railroad Company owns a substantial interest in

the Norfolk & Western (2,004 miles) operating from Norfolk, Va., to Cincinnati, O., and traversing an important section of the West Virginia bituminous coal fields.

New York Central System. The nucleus of the New York Central Lines was the consolidation, in 1853, of some sixteen independent connecting companies forming a continuous route between Albany and Buffalo. Branch lines were subsequently built or acquired. The desire to control the through traffic over its lines to and from the West led to the development of the New York Central System. The tidewater terminals are at New York and Boston and western terminals at Cincinnati, St. Louis and Chicago. By means of the Pittsburgh and Lake Erie, the New York Central enters the Pittsburgh industrial district. The leased Rome, Watertown & Ogdensburg Railroad, and the Rutland (jointly controlled with the New York, New Haven & Hartford), affords connection with Northern New York, Vermont and the Canadian cities. The total mileage of the system is approximately as follows:

New York Central System

	Miles
New York Central & Hudson River Railroad—owned	809
—Leased & Trackage	2,981
Total	3,790
Controlled Lines (directly and indirectly)	10,266
Total January 1, 1912	14,056[1]

[1] Includes the Rutland and the Kanawha & Michigan Railroads controlled jointly with other systems.

Some of the companies in the New York Central system are not controlled directly by the parent company but indirectly through other subsidiary companies. The Lake Shore & Michigan Central Railroad, for example, controls the Pittsburgh & Lake Erie and also the New York, Chicago & St. Louis Railroad. It owns besides, the stock of the Toledo & Ohio Central Railroad, which furnishes connection with the West Virginia and Ohio coal fields. Jointly with the Baltimore & Ohio Railroad, the Lake Shore & Michigan Southern owns nearly one-half of the stock of the Reading Company but this mileage is not included in the New York Central System.

The *Erie Railroad* possesses the shortest route between New York and Chicago. Unlike the New York Central and Pennsylvania systems, however, it does not reach directly the largest intermediate centers of population and industry. Its local traffic, therefore, is proportionally less important. Originally constructed to connect tidewater with Lake Erie, the main line has been extended direct to Chicago with branches to Cleveland and Cincinnati. A branch diverging from the main line at Lakawaxen, N. Y., runs southwestwardly to Scranton, Pa., and a subsidiary railroad, the New York, Susquehanna & Western, has a line direct from New York to Wilkes-Barre, Pa. These lines furnish the Erie with its large coal traffic. The Erie's system mileage on June 30, 1913, (including the New York, Susquehanna & Western) was 2,680 miles of road.

The *Baltimore & Ohio* differs from its rival trunk line systems in that its chief tide-water terminal is Baltimore and not New York City. By using the tracks of the Philadelphia & Reading and the Central Railroad of New Jersey, however, it runs trains from its own tracks into Philadelphia and New York. The Baltimore & Ohio's main line runs west to Pittsburgh and thence to Chicago, with branches along the route tapping the Lake Erie ports. Another main division runs directly west from Cumberland, Md., passing over the lines of the Baltimore & Ohio Southwestern, through Cincinnati to St. Louis. This is the originally proposed route across the Allegheny Mountains to the Ohio Valley. Pittsburgh has a direct connection with the Baltimore & Ohio's Cincinnati division through a branch running westerly and intersecting Columbus, Ohio. There are also branches and feeders reaching into the bituminous coal fields and the industrial regions of West Virginia and Ohio. In August, 1909, the Baltimore & Ohio acquired virtual control of the Cincinnati, Hamilton and Dayton Railroad, which is now a part of its system. With this addition the aggregate system mileage exceeds 5,500 miles (not including the Reading mileage).

The *Chesapeake & Ohio* has only recently become a trunk line. It is more familiarly known as a "soft coaler" running from Portsmouth, Va., through a route intersecting the Alleghenies in the West Virginia and Ohio coal fields, and passing westward to Cincinnati. In 1910 it acquired a Chicago connection

through purchase of the Chicago, Cincinnati & Louisville Railroad (renamed the Chesapeake & Ohio Railroad of Indiana). It also has an outlet to Lake Erie through control of the Hocking Valley Railroad and the Kanawha & Michigan (the latter controlled jointly with the New York Central). Its total system mileage is about 2,600 miles.

III. Anthracite Systems. The anthracite roads radiate in all directions from the anthracite coal fields in Eastern Pennsylvania. The *Reading System* (comprising the Philadelphia & Reading and the Central of New Jersey Railroads) runs easterly to Philadelphia and New York. The *Lehigh Valley* and the *Delaware, Lackawanna & Western Systems* each have terminals at New York and at Buffalo. The *New York, Ontario & Western* has terminals at New York and at Oswego on Lake Ontario. The only one of these systems that has no direct connection with New York City is the Delaware & Hudson Company (the pioneer anthracite railroad), the lines of which run from the coal fields in a northeasterly direction through Albany to the Canadian boundary. Here junction is had with Canadian lines. The anthracite roads without exception are interested, through direct or indirect ownership, in anthracite coal mines. These properties are important assets to their transportation lines.

IV. Southern Systems. The Southern systems have their principal lines in the South Atlantic states east of the Allegheny Mountains. They accordingly traverse a region largely devoted to agriculture.

The main routes, as a rule, run north and south, though each system has important intersecting lines connecting the Atlantic coast and the terminal points of the Mississippi Valley. The large railroad systems of the South similar to the Eastern trunk lines have been built up through the consolidation and purchase of connecting short lines.

The *Southern Railway* as a type of a railroad system is in some respects peculiar. It is not the result of direct extensions for the purpose of obtaining a through route between two large distributing points. By consolidating and acquiring numerous small and intersecting railroads, the Southern has come to consist of a network of lines scattered through the Southern states from the Atlantic seaboard to the Mississippi River. A main line, however, can be distinguished. This has a northern terminus at Washington, D. C., and extends all the way to Atlanta, Ga. Diverging from Atlanta there is a line running southeasterly to Brunswick and another running southwesterly through Birmingham to Mobile, Ala. An important main division, forming a route from Charleston, S. C., to Nashville, Tenn., bisects the main artery of the System. Another division starts at Knoxville, Tenn., and reaches westerly to the Mississippi River at Memphis. In addition to its own corporate lines, the Southern Railway System has been extended through control of subsidiaries. It is part owner of the *Queen & Crescent Route* running south from Cincinnati through Birmingham to Meridian and Shreveport. An-

other trunk line (the Mobile & Ohio Railroad) furnishes a direct route between Mobile, Ala., and St. Louis. From St. Louis, the "Monon" (controlled jointly with the Louisville & Nashville System) continues the line to Chicago. The following is a summary of the Southern Railway System mileage, June 30, 1912:

SOUTHERN RAILWAY SYSTEM

		Miles
Owned in fee		4,289
Leased and Trackage rights		2,325
Controlled by Stock Ownership		475
Total Operated Directly		7,089
Controlled Companies—Operated separately		
Mobile & Ohio	926	
Other Companies	733	
		1,659
Affiliated Companies		
Alabama Great Southern	357	
Cincinnati, New Orleans & Texas Pacific	336	
Georgia Southern & Florida	397	
Other Companies	117	
		1,207
Grand Total		9,955

The *Atlantic Coast Line's* main stem and branches are mostly east of the Southern Railway lines. The terminal divisions from Richmond and from Norfolk, Va., converge at Rocky Mount, Va., thus forming a main line running south to Charleston, S. C., and thence to Savannah, Ga. and to Jacksonville and Tampa, Fla. From Savannah there is a division which forms junctions with the Louisville & Nash-

ville—(a controlled but independently operated railroad system)—at Chattahoochee, Fla., and Montgomery, Ala. The branches and "feeders" along the main stem of the Atlantic Coast Line are generally short and do not reach beyond the tidewater region. This contrasts with the mountainous character of Southern Railway's territory. Exclusive of the Louisville & Nashville's lines (described separately on page 69) the Atlantic Coast Line's system road mileage on June 30, 1913, was approximately, 5,000 miles.

The *Seaboard Air Line* covers almost the identical territory of the Atlantic Coast Line. Its main stem, also extends from Richmond and from Norfolk, Va., to Tampa, Fla. An important division running west from Wilmington, N. C., bisects the main line and passes beyond, through Atlanta, to Birmingham, Ala. Another division extends from the main line at Savannah to Montgomery, Ala. The Seaboard has less branch mileage than the Atlantic Coast Line or the Southern Railway. Its physical and traffic characteristics are therefore not entirely similar. The system mileage on June 30, 1913, exceeded 3,000 miles. In addition to its rail lines, the Seaboard Air Line controls the Baltimore Steam Packet Co., plying between Norfolk & Baltimore. It also has a substantial interest in the Old Dominion Steamship Company, plying between Norfolk and New York.

V. Mississippi Valley Systems like the Southern seaboard systems have their main lines running

north and south with important branches passing east and west. The chief purpose of these systems is to connect the large centers of population along the Great Lakes with the Gulf ports. In view of the alluvial nature of the territory traversed, railroad transportation in the Mississippi Valley is subject to different operating conditions than prevail among the systems east of the Alleghenies or in the Rocky Mountain and Pacific regions.

The *Illinois Central* is the oldest of the Mississippi Valley systems. Its main artery is a direct route between Chicago and New Orleans. An important division that runs from Chicago directly west to Sioux City (where there is connection with the Union Pacific) is outside of the territory of the main lines. Numerous branches and intersecting lines bring the system into communication with the important intermediate centers of traffic, notably Springfield, Ill., Indianapolis, St. Louis, Louisville, Memphis, Birmingham and Vicksburg. The control of the Central of Georgia Railroad acquired in 1910 gives a connection (from Birmingham, Ala.) with the Atlantic tidewater at Savannah, Ga. The lower Mississippi River points from Memphis to New Orleans are reached by the Yazoo & Mississippi Valley Railroad, a separately operated but integral part of the Illinois Central System. The approximate mileage of the companies owned and controlled are substantially as follows:

	Miles
Illinois Central R. R. Co.	4,755.25
Louisville & Wadley R. R. Co.	10.00
Wadley Southern Ry. Co.	90.00
Wrightsville & Tennille R. R. Co.	105.17
Yazoo & Mississippi Valley R. R. Co.	1,371.98
Central of Georgia Ry. Co.	1,915.42
Total	8,247.82

The *Louisville & Nashville System* is under the administrative control of the Atlantic Coast line, the owner of 51 per cent. of its capital stock. It is, however, an independent system in itself. The main stem of the Louisville & Nashville extends from Cincinnati, O., to Pensacola (Fla.), on the Gulf of Mexico. Its main mileage, therefore, is east of the Illinois Central lines. Two divisions in the northern part of the System connect the two important centers, St. Louis and Memphis, and a branch near the southern terminus brings the lines into direct connection with New Orleans. These are important arteries for supplying traffic. Another division, separate from the main stem, runs directly south from the Cincinnati terminus to Atlanta, Ga., passing through a large coal mining district. Here it connects with the leased Georgia Railroad and Banking Company lines which furnish connection with Augusta and other Georgia junction points. On June 30, 1912, the system was constituted as follows:

	Miles
Lines owned entirely	4,071
Leased Lines	669
Total directly operated	4,740
Lines controlled or operated separately	3,208
Total System	7,948

The lines of the *St. Louis & San Francisco System* for the most part lie at considerable distance from the Mississippi River. An important eastern artery, however, furnishes a route from Chicago to New Orleans. Entrance to New Orleans was acquired in 1911 through a joint control (with the Louisville & Nashville) of the New Orleans, Mobile & Chicago Railroad. Although the 'Frisco's corporate lines have their northern terminal points at Kansas City and St. Louis, the ownership of the Chicago & Eastern Illinois Railroad furnishes a route north to Chicago. Thus, the St. Louis & San Francisco system has lines connecting Chicago and the Gulf points. These lines, however, have not the directness of the other Mississippi Valley systems. Because of its numerous intersecting and zig-zag branches the main arteries of the 'Frisco System are difficult to distinguish. This is a disadvantage in the competition for through traffic. The 'Frisco, in 1910, acquired a substantial hold on the traffic moving along the Gulf Coast by purchasing the St. Louis, Brownsville & Mexico Railroad (line from Brownsville at the mouth of the Rio Grande River to Galveston) and combining it with the New Orleans, Texas & Mexico Railroad, connecting Galveston with New Orleans. The following are the principal constituent companies of the 'Frisco System:

St. Louis & San Francisco System

	Mileage
St. Louis & San Francisco R. R. Co.	4,731.88
Chicago & Eastern Illinois R. R. Co.	1,275.38
Fort Worth & Rio Grande Ry. Co.	235.22
New Orleans, Texas & Mexico R. R. Co.	264.48
St. Louis, Brownsville & Mexico Ry. Co.	509.85
St. Louis, San Francisco & Texas Ry. Co.	243.33
Other Lines	265.53
Total	7,524.67

The *Missouri, Kansas & Texas*, and the *Kansas City Southern* cover nearly identical territory. The main stem of each runs from Kansas City to the Gulf. The Missouri, Kansas & Texas has its southern terminus at Galveston, and the Kansas City Southern at Port Arthur. The unique feature of the Kansas City Southern is that it has no branch mileage other than two spurs; one connecting with Ft. Smith, Ark., and the other running from De Quincy to Lake Charles, La. These together represent but 40 miles of a total system of 834 miles. Unlike its rival system, the "Katy," as the Missouri, Kansas & Texas is familiarly known, has a fairly large proportion of branch mileage. This gives it an advantage in reaching a greater number of traffic centers. Thus, as northern terminals, in addition to Kansas City, it has Alton, Ill., St. Louis, Hannibal, Mo., and Junction City, Kansas. Branches and divisions supplementary to the main line reach important intermediate towns in Oklahoma, in Louisiana and in Texas. In all, the "Katy" system comprises in the neighborhood of 4,000 miles.

VI. Middle Western Systems in the North. The independent lines operating in the geographical division bordering along the Great Lakes west of Buffalo and east of Chicago and St. Louis are a relatively unimportant group. Most of the lines in this territory are subsidiaries of the Eastern Trunk Lines or other leading railroad systems. Even the *Wabash Railroad System*, which has its main divisions in this region, was intended as an eastern extension of the Missouri Pacific System. The receivership of the Wabash Railroad and of its Pittsburgh connections, (the Wheeling & Lake Erie and the Wabash Pittsburgh Terminal Company), establishes its independence as a railroad organization. The western terminals of the Wabash are at Council Bluffs, Omaha and Kansas City, and the eastern terminals are Detroit, Buffalo and Pittsburgh. It is very probable that in a reorganization, the Pittsburgh connections will be lost. Buffalo is reached from Detroit over the tracks of the Grand Trunk Railway in Canada. An important division of the Wabash is the Chicago-Toledo Line, one of the shortest routes from Chicago to Toledo. The total mileage of the Wabash System (exclusive of its Pittsburgh subsidiaries) is approximately, 2,500 miles.

The *Toledo, St. Louis & Western System* comprises the Toledo, St. Louis & Western Railroad and the *Chicago & Alton Railroad.* The latter was acquired in 1907 through purchase of a majority of capital stock. St. Louis is the only point of convergence of

the lines of the two companies. A main stem of the Chicago & Alton is a direct route north into Chicago and another runs westerly into Kansas City. The Toledo, St. Louis & Western furnishes a short northeast route from St. Louis to Toledo and Detroit. Together, the lines of the two companies comprise approximately 1,500 miles.

VII. The Northwestern Trunk Line Systems. These systems include the principal railroads operating throughout the region west and northwest of Chicago. Not all have direct entrance to Chicago. The Union Pacific, one of the important systems in the group, has its eastern termini at Omaha and Kansas City. By means of junctions and traffic interchange arrangements with other systems it suffers no great loss of through business.[1] The Great Northern and Northern Pacific likewise do not enter Chicago. Both, however, are assured favorable traffic interchange conditions with the western metropolis through their joint control of the Chicago, Burlington & Quincy Railroad, which, aside from its numerous branches and feeders, has a direct line into Chicago.

Several of the important systems which originate in Chicago and reach out toward the West, do not as yet possess Pacific terminals. Important among these are the Chicago & North Western and the Burlington; but the "Burlington" has connection with

[1] The late E. H. Harriman, referring to the Union Pacific's isolated location at the time he became its active administrator, described it as a railroad "beginning nowhere and ending nowhere."

the Hill lines, and the "Northwestern" exchanges Coast traffic with the Union Pacific.

The varying topographical characteristics and the sparsity of population west of Chicago causes the northwestern systems to differ from the eastern trunk lines in both physical and traffic features. The length of their mileage in relation to the business done is much greater, and commodities are hauled longer distances. The agricultural character of the territory served requires numerous branches of light traffic. The physical facilities and traffic conditions, therefore, are not comparable with railroads traversing densely populated sections.

The *Union Pacific System*, as already mentioned on page 73, has no line into Chicago. From each of its eastern termini, Kansas City and Omaha, a line runs parallel directly west. The line from Kansas City is a short route to Denver, Colo. The line from Omaha is the shortest route to Ogden, Utah, and constitutes the main stem of the system. It is connected with the Denver division by a branch running north from the city of Denver. Three arteries extend from Ogden to the Coast. One, running northwesterly via Oregon Short Line, reaches the ports of Puget Sound. The central artery (the Central Pacific, a subsidiary of the Southern Pacific) runs through the Sierra Mountains direct to San Francisco. The third line (the San Pedro, Los Angeles & Salt Lake Railroad) is a short route to Los Angeles and Southern California. The strategic value of these arteries, from a business standpoint, is

of the highest importance to the Union Pacific. Their possession gives the system participation in the long haul traffic to and from the Pacific Coast. The branches of the Southern Pacific Company (until recently controlled by stock ownership), through junction with the Union Pacific lines, afford a means for collecting and distributing this traffic. Several minor divisions of the Union Pacific bring the system into direct communication with leading intermediate business centers such as Butte, Mont., and Spokane, Wash. There are also a number of small "feeders" in the grain growing region. These together with the main lines and the proprietary mileage, aggregated on June 30, 1912, approximately 7,500 miles of road.

The *Great Northern and Northern Pacific* systems although under one personal administrative control are operated entirely independently. They are in many respects parallel and competing lines covering almost identical territory. Their eastern termini are at Duluth, Wis., and St. Paul, Minn., and the Western termini at points along Puget Sound. The Northern Pacific lines, however, run mainly directly west, whereas, the Great Northern's principal lines run northwesterly along the Canadian border. The Northern Pacific, however, has a branch directly north from Winnipeg Junction, Minn., to Winnipeg, Canada. Thus, both systems participate in the grain movement from the Canadian wheat fields to Chicago. The branch lines and "feeders" of the Great Northern lie mainly in the wheat growing

section of North Dakota and in the iron ore lands of Minnesota. The movement of these commodities is an important element in this company's traffic. Both systems have developed branch lines in the State of Washington. By means of the jointly controlled Spokane, Portland and Seattle Railway connection is afforded with a newly developed country rich in agricultural and commercial possibilities. Exclusive of this subsidiary (of approximately 600 miles) the mileage of the Great Northern on June 30, 1912, was about 7,400 miles and that of the Northern Pacific 6,700 miles.

The *Chicago & North Western System* is the product of more than fifty years of continuous development. Its net work of lines unites Chicago with all the important traffic centers in the states of Wisconsin, Minnesota, South Dakota and Nebraska. With its main subsidiary, the Chicago, St. Paul, Minneapolis & Omaha Railroad, (the "Omaha") it comprises in all approximately 9,000 miles of which only a very small portion represents leased lines or trackage rights.

The *Chicago, Milwaukee & St. Paul System*, familiarly known as the St. Paul, covers practically the same territory as the "Northwestern." Many of their lines are parallel and competing. The St. Paul, besides having a line to Kansas City not duplicated by its rival, completed in 1911 a Pacific Coast extension, the Chicago, Milwaukee & Puget Sound Railroad. This extension, built to preserve St. Paul's "through" business from competing

systems, comprises 1,400 miles of road. The development of branch lines and "feeders" will undoubtedly add to the mileage. With the Coast extension, the "St. Paul" aggregates approximately 9,000 miles of road. All but a very small part is owned in fee.

The *Minneapolis, St. Paul & Sault Ste. Marie System*, (the "Soo"), constitutes the main mileage of the Canadian Pacific lines in the United States. By means of the "Soo," the Canadian Pacific participates in the through traffic between Chicago and Vancouver, its main Pacific Coast terminal. The Canadian Pacific, therefore, is an active competitor of the Northwestern Trunk Lines in the United States. The "Soo" System, beginning at Chicago (with the main line of the Wisconsin Central) connects with the Canadian Pacific at Duluth and along the international boundary line of North Dakota. Duluth is reached through affiliation with the Duluth, South Shore & Atlantic Railroad. Although passing through a large grain section the "Soo" is not as well provided with branches and "feeders" as its rival systems. Its aggregate mileage, therefore, is considerably less.

The *Chicago, Burlington & Quincy System*, "the Burlington", like the "Northwestern" and the "St. Paul," has its base stem in Chicago, with main lines running directly west and with numerous intersecting branches and "feeders." The principal western termini are Denver, Colo., Cheyenne and Billings, Mont. From Denver and Cheyenne, junctions are formed with the Colorado & Southern

(controlled through stock ownership). This subsidiary affords the Burlington a Gulf outlet. At Billings and also at Fromberg, Mont., traffic is interchanged with the Great Northern and Northern Pacific Systems. Because of its extensive main lines and its many branches and "feeders," the Burlington System (including the Colorado & Southern lines) comprises in all about 11,800 miles of road. This is the largest mileage of any of the western trunk line systems.

VIII. The Southwestern Systems. The expansion of the southwestern trunk lines has the same goal as the northwestern systems. The aim is a through, unbroken track between Chicago and the Pacific Coast. A secondary objective point is the Mexican Gulf ports. These systems, accordingly, compete partially for "through" business with the northwestern as well as with the Mississippi Valley systems. Like the northwestern lines, the mileage of the southwestern group is quite extensive. The region traversed is vast and, for the most part, thinly populated. The companies with lines passing over the Rockies have difficult grades to contend with. All these factors influence the physical and traffic characteristics of the southwestern railroads, marking them apart from railroads in other geographical divisions.

The *Southern Pacific System* has one great point of difference from the other systems in the "Southwestern group." The direction of its longest transcontinental line has no relationship with the traffic

between Chicago and the Pacific or the Gulf. Its Central Pacific line, extending from San Francisco to Ogden, Utah, is more properly an integral part of the Union Pacific System, and constituted the latter's most important asset in its former control of the Southern Pacific Company.

The main artery of the Southern Pacific extends from the mouth of the Mississippi River (where traffic is exchanged with controlled steamship systems plying between New York and the Gulf) through Louisiana and lower Texas, and along the Mexican border to Los Angeles, San Francisco and as far north as Portland, Ore. Here a junction is formed with the Union Pacific lines. The branch lines and "feeders" of the Southern Pacific are mostly in eastern Texas and in central California. Mexican connections are being developed by the construction of a line from the main stem in Arizona along the western coast of Mexico. The aggregate mileage of the Southern Pacific System (including the Central Pacific) on June 30, 1912, was 11,600 miles.

The *Atchison, Topeka & Santa Fé* is the only railroad which has a direct route over its corporate lines from Chicago to San Francisco. Its base stem from Chicago runs southwesterly through Kansas, Oklahoma and the Panhandle of Texas. Thence, paralleling the Southern Pacific's main line, it passes through New Mexico, Arizona, and Central California. A branch running north reaches Denver, and two others from the main line converge at Galveston.

The Atchison, therefore, competes with the Southern Pacific for through business exchanged between California and the Gulf of Mexico. A net work of small branch lines and "feeders" is confined principally to the grain growing section of Kansas and Oklahoma. The Atchison lines as a whole comprise about 10,500 miles of road.

The *Missouri Pacific System*, including the Denver & Rio Grande lines, though lately having completed a Pacific Coast connection, has no extension into Chicago unless the Wabash is still to be considered an integral part of its lines. St. Louis, Mo., is the base stem from which the Missouri Pacific lines originate and spread out over the important traffic centers of the Great West. The most northerly point reached is Omaha through a branch running from Kansas City. New Orleans, Galveston, Laredo and El Paso on the Mexican border are southern termini, but none of these points are reached by "short cuts." Thus, the Missouri Pacific lines in competing for the through business from St. Louis to the Gulf and Mexican points are at a disadvantage as compared with other lines having more direct routes. The junction with the Denver & Rio Grande System is at Pueblo, Colorado. At this point a series of lines in all directions covers the central region of the Rocky Mountains. Denver lies more than 100 miles north of Pueblo and is therefore off the direct transcontinental route which passes from Pueblo over the mountains to Salt Lake City and Ogden, Utah. The eastern terminus of

the Western Pacific, (the newly completed Coast extension of the Denver & Rio Grande Railroad), is at Salt Lake City. This line runs directly west to San Francisco, paralleling a large part of the Central Pacific Railroad. Notwithstanding the recent extensions and the vast net work of lines (all of which give the Missouri Pacific and Denver & Rio Grande systems together more than 13,000 miles of road) these "Gould Lines" do not, as yet, command a traffic interchange commensurate with their location and mileage.

The *Rock Island System* in proportion to its mileage covers a wider territory than any of the other western systems. Its lines traverse almost all the states between the Mississippi River and the Rocky Mountains. The main stem rising at Chicago, extends directly west through Omaha to Denver. Diverging north from this line are two divisions, with intersecting branches. One terminates at Watertown, S. D., and the other at St. Paul. Another important division extends from Rock Island, Ill., all the way to the Mexican border at El Paso. From this line there are two parallel branches, one reaching to Memphis and the other to Kansas City and St. Louis. Thus, the Rock Island is well provided with facilities for through traffic to and from Mexico. It has not yet developed sufficient branches to furnish a large local business, especially in the grain and cotton growing sections. Because of extensive main lines, however, the Rock Island System comprises about 8,000 miles of road.

TRAFFIC INTERCHANGE AGREEMENTS

The foregoing concise description of the leading railroad systems in the United States is largely for the purpose of pointing out the influence of geographical location on railroad operations, and the strategic advantage in competition acquired by the railroad systems having favorable routes for through business. An additional factor influencing operating results are the contracts or arrangements for interchange of traffic with connecting and independent lines. The terms of these agreements, if favorable, may afford to a railroad company all the advantages of system extension. In fact the difficulties in obtaining favorable terms as against competing railroads frequently led to the actual purchase or administrative control of connecting lines forming a complete "through traffic" route. By favoring the shipments of one connecting line over those of another or by interchanging freight exclusively with one of several competing lines, a small intermediate railroad might be used as the means of crushing a rival railroad system. An analogous situation was the motive for the St. Paul's Pacific Coast extension. Up to 1906, St. Paul was creating a large volume of business on its lines and turning it over to connecting roads. Because competing systems employed the Burlington as a Chicago extension, and because of the traffic alliance of the Union Pacific and the Chicago & North Western, the St. Paul did not receive its proper share of interchanged tonnage. Nat-

urally, the St. Paul wanted to get as much business as possible. So the Pacific Coast extension was built (the Chicago, Milwaukee & Puget Sound Railroad); a venture which cost more than $150,000,000.

A good illustration of a mutually favorable traffic interchange agreement is that in force between the Kansas City Southern, on the one hand, and the Union Pacific and Southern Pacific lines, on the other. This agreement was made in January, 1909. The Kansas City Southern is a trunk line forming a junction with the Union Pacific at Kansas City and running directly south to a junction with the Southern Pacific at Shreveport, La., and Beaumont, Texas. It is thus a natural link in the Harriman lines. By the terms of the traffic agreement, the Kansas City Southern becomes a through line for the transportation of freight interchanged by the parties between (1) points on or west of the Mississippi River and (2) points in what is commonly known as "Seaboard Territory." A substantial increase in Kansas City Southern's business is the natural outcome of this arrangement.[1]

A more recent and noteworthy traffic alliance is that between the New York Central Lines and the Western Maryland Railroad for the movement of freight between Pittsburgh and Baltimore. This agreement permits coal from the Pittsburgh district to be laid down in Baltimore and other eastern tidewater destinations in competition with coal from

[1] This agreement may cease because of the segregation of the Union Pacific and Southern Pacific systems.

Virginia, West Virginia, Kentucky and Tennessee coal fields. This means an influx of coal to eastern tidewater from a new source. Unless a freight rate war with competing systems causes the new business to be carried at a loss, both contracting companies will benefit through the additional revenue furnished by the traffic interchange.

Other instances of advantageous traffic interchange arrangements could be pointed out. The purpose here, however, is merely to call attention to the influence of these alliances on railroad earning power. New developments of this kind are worthy of close study and analysis by all who are interested in railroad values or railroad operating results.

CHAPTER IV

ECONOMICS OF RAILROAD CONSTRUCTION

Railroad activities can be broadly divided into construction and operation. The investor and the student of transportation are concerned equally with both branches. Successful railroad operation from a financial viewpoint is largely dependent upon the character and cost of the physical construction. Therefore, a proper understanding and interpretation of operating statistics and accounts demands at least an elementary knowledge of the underlying economic principles of railroad construction.

Investment Basis of Railroad Construction. From a strictly business viewpoint there is but one dominant motive for railroad construction, viz., the probability of a profit on the money thus invested. It must be assumed, therefore, throughout this work, that a railroad project is undertaken primarily as an investment to those supplying the capital. The fact that the greater part of railroad construction in the United States has not successfully fulfilled this purpose for the original security holders does not invalidate this assumption. Unlike industrial enterprises, American railroads have not been built with funds furnished exclusively by the promoters. From their inception, large capital expenditures required

the financial participation of the public as investors. This renders all the more important a proper interpretation of the fundamental principles of railroad promotion and construction.[1]

When a project for a new railroad is proposed, the first problem considered by promoters is whether the need for the line justifies the construction expense. The size and character of the places to be connected and the resources of the surrounding territory, considered in connection with existing transportation facilities, are factors influencing the solution of this problem. As pointed out by Mr. W. L. Webb,[2] "The economic considerations underlying the building of railroads in the United States are now fundamentally different from those existing fifty and sixty years ago." At that time the greater part of the United States was sparsely settled. It

[1] Comparatively little comprehensive study has been undertaken on the subject of economics of railroad construction since that conducted by the late A. M. Wellington and included in his book on "Economics of Railway Location," which was first published in 1887 and revised two years later. In spite of the fact that a great many changes have taken place in both track and locomotive design and operation in the past twenty-five years, this book is still standard today, although the figures given in it are out of date. There is opportunity and demand for similar studies of operating conditions at the present time, in order to put out a standard authority for use under present day operating conditions. The most thorough contribution in this line made in recent years was that by J. B. Berry on Grade Revision on the Union Pacific, published as a bulletin of the American Railway Engineering Association in 1904. A similar paper was prepared by John D. Isaacs outlining the study made before grade revision was undertaken on the main line of the Southern Pacific.

[2] "Economics of Railroad Construction," p. 66.

was then more a question of creating traffic through aiding economic development than of insufficient or of oversupply of transportation facilities. In these days of restricted national expansion, however, railroad construction is frequently undertaken on a different basis than in earlier years. In fact, having in most cases acquired the best available routes and the most advantageous territorial connections, future development of American railroads (with the exception of the extreme western lines) will be largely a duplication of transportation facilities by the construction of competing lines. Moreover, the growth in traffic of all kinds, besides developing rival railroad systems, necessitates improvements in the form of branches and feeders, additional main tracks, revision of grades and the like.

The records of early railroad building prove that capital is not likely to be risked in new enterprises without the speculative possibility of a larger return than can be obtained from a more secure investment. The encouragement given by the State and Federal Governments through land grants and other subsidies to the early railroads was a matter of necessity rather than choice. Much traffic is necessary for profit in railroad operation; consequently, unless a line is built in a well settled territory insufficiently supplied with railroad facilities, the profits are purely speculative.

The Nature of the Prospectus. In view of the speculative character of new railroad enterprises, when undertaken on a purely business basis without State

subsidy or guaranty, successful railroad promotion requires careful analysis of underlying conditions. Ordinarily, when an independent line is planned and public participation is invited by the promoters, a "prospectus" regarding the enterprise is prepared. This document usually gives details of the proposed character and the route of the contemplated line; the resources of the country traversed, and the communicating transportation facilities for traffic interchange. It also generally includes the reports and opinions of engineers, financiers and other experts. These are naturally favorable to the venture.

The Estimated Volume of Traffic. Assuming as feasible the construction of a new railroad, the first problem in the prospectus is the *probable volume of traffic*. Various methods are followed in estimating this item. The earnings of other lines in the same territory are sometimes taken as a basis. The tributary population and the natural resources are elements of importance; and also the character of the existing industries or those capable of development. The opportunities of traffic interchange with other transportation systems, on the one hand, and the probable or potential competition of rival carriers on the other, are additional factors. That no one of these criteria, singly, offers a safe and satisfactory basis for sound railway promotion is readily apparent. They all require proper weighing. Modifications should be made to accord with the proposed physical character of the line and the territory to be served. Even after the most cautious analysis

there is no certainty of safety of investment, — unless obtained from an extraneous source, such as a State warranty. Whoever advances funds for the building of a railroad, though possibly a public benefactor, is nevertheless a speculator. Some speculation is absolutely necessary in modern railroad promotion, even when supported by wealthy and prominent financiers or by the credit of an existing railroad system.

As an illustration of the methods actually employed in estimating probable traffic on a proposed new railroad line, the following extract from the report of J. G. White & Co., on the Delaware & Eastern Railway, (when under construction from East Branch, N. Y., to Schenectady, N. Y.), is given:

The greater part of your revenue from local traffic must accrue from the carriage of freight and milk. The local passenger business must be relatively small. Outside of the City of Schenectady, the population centers on the Delaware & Eastern aggregate about 8,000 people. The intermediate sections have a farming population. . . . The commodities that will make up the bulk of your local freight traffic, are principally lumber, blue stone, agricultural implements, hardware and general supplies, coal, cement, paints, etc. The tendency on your present railroad has been to introduce wood working factories, acid factories, etc., so that a considerable portion of the various local products are manufactured into articles that pay a high rate of freight. . . .

In the study of the probable freight traffic on this line it may be useful to consider the traffic on the Ulster & Delaware Railroad, which runs in an easterly and westerly direction from Oneonta on the Delaware & Hudson Railroad, 107 miles to Kingston Point on the Hudson River. It also has branches aggregating about 22 miles, making its total main single track mileage 128.9 miles. . . . The geographical position of the proposed Delaware & Eastern Railway is a direct line between the coal and iron region and the northern portion of the manufacturing New England States, and its direct connections with five of the large railroad

systems of the East would imply that it might naturally receive a good share of the very large and increasing through traffic that is passing in both directions between these two districts.

The Rates to be Charged. Volume of traffic is but one element in the profitableness of a transportation enterprise. Of equal importance are the rates that can be charged. It was pointed out in a previous chapter that the economic justification of the transportation service is that it is profitable both to the shipper and to the transportation company. If the shipper does not profit through the transportation of his goods he will dispose of them at home. If the transportation company cannot make a profit by hauling the goods, it must increase its charges or be operated continuously at a loss. Hence, the economic limits of rates that can be charged for the transportation service. On a new railroad it may not be merely a question of determining what rates the traffic will bear, but also what rates will best encourage and develop a traffic which will yield the largest net revenue. The danger of fixing the rates above this level even in the absence of competition may result disastrously to the security holders. For example, a railroad is built through a section favorable for dairying. The milk traffic is estimated to be an important element in the expected revenue. In view of the special "express service" required for this commodity, the rates to yield a profit, must greatly exceed (from five to even ten times as much) what might be the charge for ordinary freight service. But whether the dairymen will be able to pay

the proposed rate depends (1) on the length of haul to the market in competition with milk shipped from other localities and (2) the price obtained for the product at its destination. If, under these conditions, the rate is too high, the dairymen will not ship the milk. They may convert it into cheese, and this article is of small bulk and may be shipped as ordinary freight. Hence, the railroad fails to obtain the large revenue expected from the milk service.

The fixing of rates for lumber traffic in a forest region comes under the same limitations. Unless the new railroad can afford to encourage timber operations through low rates and through the building of tap lines, it may fail to develop this traffic. Thus, many enterprises which are passed on favorably as capable of securing a large local traffic fail to earn the sums estimated.

In the matter of through business, estimated as coming from connecting lines, similar disappointments may result. Even with traffic interchange agreements and joint rates as described on p. 82, the share of the revenue allotted to the new line may not be sufficient to yield a profit. Uncertainties of this character are largely responsible for the almost entire absence of independent railroad promotion. New construction is now mainly under the auspices of established railroad systems.

Selection of the Route. In addition to the calculation of the probable traffic and revenue, there are further problems requiring solution in new railroad

construction. The selection of the route is a factor of prime importance. Generally, the proposed line is to lie between two termini, determined in advance and set down in the company's charter. Several routes may be surveyed with a view to both economical construction cost and favorable traffic sources. A prime motive is to bring the line in connection with as many intermediate centers of traffic as may be possible within the region traversed. The tapping of an additional traffic center may mean more than a mere interchange of tonnage with this point. It frequently effects a connecting link with tributary communities and with sections of territory far distant from the direct route of the main line.

The extension of railroads for the purpose of reaching new stations may entail heavy additional construction cost, but this may be more than offset by resulting growth in business. The reason is that intercourse and communication tend to increase at an accelerated ratio with each additional station. Thus, three localities, A, B, and C, when brought into communication or traffic interchange, theoretically, will have six opportunities for intercourse: *A with B*, *B with A*, *A with C*, *C with A*, *B with C*, and *C with B*. By adding a fourth station (D) there will be twelve separate opportunities for intercourse, computed in the same way, and when five localities are brought into communication there are twenty opportunities for traffic interchange. This multiplication of opportunities continues at the same rate as new stations are reached. When new stations

afford an opportunity for intercourse through their existing transportation facilities with other stations off the route of the new line, the possible expansion of business may be even greater than represented in the above calculations. In this way, traffic may expand in a geometrical ratio when stations increase in an arithmetical ratio. The economic importance of reaching large cities, therefore, as already pointed out in the previous chapter, can hardly be over-estimated. The great mistake in the original construction of the Erie Railroad, according to plans of the New York legislature, was that the route selected purposely led away from the large centers of population in order not to have the railroad interfere with the business of the State canal.

The Estimate of Construction Cost is a problem as vital as the selection of a proper route. Obviously, this matter can be handled only by expert engineers. The physical character of the line proposed and the volume of traffic to be handled, as well as the geological and engineering difficulties which must be overcome, are leading elements in the cost estimates. If a railroad is to be built to compete with high-class lines for through business and, at the same time, to afford equally good facilities for local business, it must be strongly and well constructed. Moreover, the topography of the selected route must be favorable in order to attract business from competing lines.

In estimating construction costs, engineers fre-

quently study the experience of similar lines already in operation. This method, however, may fail to consider cost changes that have taken place since the existing lines were built. Advances in property values, for example, are constantly compelling the railroads to pay more for right-of-way and for terminals. In fact, few details connected with the construction of a new line or with the improvement of existing facilities are the source of so much trouble in engineering estimates as the purchase of right-of-way and the provision of proper terminals. The mere announcement of a railroad project increases land values along the route, and even with condemnation proceedings or appraisal boards, the railroad pays the enhanced price. In one case, where a Middle Western line desired a right of way through a prosperous farming community, the farmers managed to have their friends appointed as condemnation commissioners with the result that the road paid over $1,000 per acre for right-of-way when adjacent land was selling at not over $150 per acre.

The question of terminal land expense is always a troublesome one. To secure a maximum business, a railroad must have its terminals near the town centers, otherwise heavy drayage costs to freight shippers and receivers, or the expense and inconvenience to passengers in going to and from the station will hinder large traffic.[1] But city property is costly, especially when the sites are already occupied by buildings. It is therefore of great economic

[1] This subject is discussed in greater detail on p. 120.

advantage to new and independent lines to secure by lease or joint purchase the use of terminal facilities of existing lines. In this way construction costs can be greatly reduced.

In view of the topographical disparities and the diverse conditions affecting costs of land, materials and wages in different localities and at different times, engineers can lay down no definite rules regarding the various elements of railroad construction costs. The following table of percentages compiled by John F. Wallace and published some fifteen years ago in the *Engineering Magazine*,[1] is given merely as an interesting example of this sort of work.

Element of Cost	*Main Line* %	*Secondary Main Line* %	*Minor Branches* %
Right of way	5.0	5.6	6.7
Fencing	1.0	1.6	2.0
Grading	30.0	24.0	20.0
Bridges and Culverts	10.0	10.0	10.0
Telegraph	0.7	1.2	1.3
Track, Material and Labor	17.5	25.6	40.0
Ballast	7.5	9.6	0.0
Water Supply, Stations, etc.	2.5	2.8	3.3
Rolling Stock and Equipment	10.0	10.0	9.3
Proportion of Terminals	12.5	6.0	3.3
Engineering	1.8	2.0	2.7
General and Legal	1.5	1.6	1.3
	100.0	100.0	100.0

[1] Quoted by A. M. Van Ayken, *Railway Age Gazette*, March 8, 1912.

The Fundamental Economic Principle of Modern Railroad Construction. Conscientious railroad promoters and financiers may assure themselves of the strategic position of the proposed line; of its resources and of its future, and may even test in every detail the cost estimates as to roadbed, superstructures, equipment, terminals and other essentials; yet they cannot with all these precautions assume that the investment will be reasonably safe. Further precautions are necessary. At the basis of all economic railroad building lies the fundamental maxim, *that the construction is to be done at as small cost as is consistent with the rate of return expected from the probable volume of traffic.* If the cost is excessive the enterprise will not pay for the capital investment. If it is built inadequately for the traffic the enterprise will likewise prove unsuccessful. Such was the experience of the Kansas City, Pittsburgh & Gulf Railroad, the predecessor of the Kansas City Southern. After a receivership and reorganization, this line had to be substantially rebuilt to meet traffic requirements.

That many American railroads, however, have been originally constructed more cheaply than present day standards warrant was economically justified by the character of traffic prevailing at their inception. To have discounted future demands too far in advance might have proven financially disastrous to the original owners. In fact, before condemning American railroad promoters for not having constructed and equipped the lines up to the

highest standards, the conditions under which these were built should be considered. The railroads of Europe were from the first constructed in countries already densely populated and in a high state of economic advancement. They were sure of a large traffic from the start. The railroads of the United States were largely built through territory having a sparse population and little economic development. They were required to attract population and build up industry for traffic. Hence, it was necessary to build them cheaply if they were to be built at all. Even though inexpensively constructed, the traffic for them was so light that only those situated in well developed sections were able to earn a return on their comparatively small investment.

Even in cases where there is every probability of future development of large traffic, it frequently is a financial loss to provide facilities of extended durability and beyond immediate requirements. Since money when compounded at 6% interest yearly will double itself in twelve years, it is manifestly not economy to tie up funds in idle property for the purpose of discounting too far in advance future contingencies. The fact should not be overlooked that capital expended but not immediately or fully used demands a current interest payment the same as that which is in active and full use.

The progressive physical improvement of American railroads in some instances has effected almost an entire reconstruction of the properties. This expenditure in large part is the cost of progress. It

is not necessarily due to errors of judgment or of engineering practice. The cost of these improvements therefore should be borne by those who use as well as by those who furnish the transportation service. Engineers and financiers are expected to exercise proper judgment in sanctioning improvements and new construction. The ordinary layman who advances funds for these purposes or who is otherwise financially interested in railroad enterprise must have full confidence in their judgment, if he himself is not able to judge properly the economic expedience of such expenditures.

The wisdom of extending branch mileage is likewise a problem requiring trained judgment. Inasmuch as the construction cost of a railroad should be in accord with the traffic over its lines, it follows as a necessary corollary that a branch line, feeder, or any physical extension or betterment should not cause an additional capital investment on which a fair return cannot be anticipated. Although it is true that in most cases branch mileage adds to traffic and earning power, the net return therefrom, as measured by the cost of the extension, is frequently lower than the profit from the main lines. No system of railroad accounting has yet been evolved which can satisfactorily distinguish in branch mileage between "feeders" which furnish profits and "suckers" which cause losses. Moreover, the extension of branches into unremunerative territory is not always undertaken with the expectation of an immediate net return. Branch

mileage and extensions are frequently constructed or purchased merely to ward off competition or for political or remotely speculative reasons. Such speculative railroad building is undoubtedly an evil because of capital waste, though the incidental results may finally justify the expenditure of capital.

Because of the fundamental importance of gauging construction expenditure not only of new railroads but also of systems already in operation, it may be well to point out actual instances in which the economic principle of confining the investment within the limits on which a reasonable return can be immediately expected has been ignored. The Virginian Railroad, extending from the coal fields at Clearwater, West Virginia, to tidewater at Norfolk, Virginia, is probably the best example of recent times. The late H. H. Rogers, the promoter and owner, a wealthy financier, with no experience in railroad matters, desired to have a coal carrying line far superior to any other in the land. The latest, most approved and most costly engineering features for handling heavy traffic were installed. All grades were practically eliminated and curves were reduced as far as possible, though at heavy capital cost. When finally completed to tidewater, at a construction cost of over $185,000 per mile, the railroad was capable of hauling over its lines an annual traffic equal to one-half the then total coal consumption in the United States. To develop this amount of business may require the lapse of a quarter, or even

a half century. The excess capital expenditure, therefore, when compounded at the current interest rate will have trebled before it brings in a maximum return. Fortunately, in this case, a private estate bears the financial burden and no public loss entailing receivership and reorganization is involved.

An instance of spectacular railroad building representing a physical reconstruction of an old line is the Delaware, Lackawanna & Western "cut off" extending from Port Morris, N. J., to Slateford, Pa., a distance of twenty-eight miles. The cost of this structure is reported as approximately $1,500,000 per mile. Its purpose was the elimination of curves and the shortening of the route eleven miles between New York and Buffalo. Another "cut off" on the same railroad from Clarks Summit to Hallstead, Pa., thirty-eight miles, reducing the length of the railroad 3.6 miles is estimated to cost when completed from $10,000,000 to $15,000,000. Obviously, costly improvements of this character are not expected to net an immediate return to the railroad company. The large earning power and immense financial resources of the Delaware, Lackawanna & Western alone render the expenditure possible.

In contrast with the liberal construction policies of the Virginian and the Lackawanna railroads, the Missouri Pacific may be taken as an instance of inadequate new capital expenditure through inability to provide facilities for its business. Compared with other trunk lines operating in the same territory, its cars and other equipment had for a time

become inferior. The business of the company could not be handled properly. The effect was an impairment of net earning capacity. When improvements are completed the road may be expected to again compete favorably for remunerative traffic.

CHAPTER V

PHYSICAL FACTORS IN ECONOMIC OPERATION: WAY AND STRUCTURES

The general principles inherent in economic railroad construction lead up to the study of the physical factors influencing railway operations and earnings. The location of roadbed and superstructure, the quality and quantity of the rolling stock, the character of the terminal facilities, all are elements which, combined with wise financial policy, efficient management and a paying traffic determine the safety of the investment represented by the outstanding securities. The problems of physical structure belong to the realm of the engineer. Investors and transportation students, however, are also concerned with these problems and cannot afford to neglect them entirely. Public safety and operating efficiency require adequate physical facilities. Railroads are constantly demanding additional capital for extensions and betterments. It is with the object of assisting a proper judgment as to whether the interests of both security holders and the public are safeguarded in such matters that the following discussion of railroad physical features is presented.

RAILWAY LOCATION

A consideration of location can be limited to the three leading factors: (1) Distance, (2) Grades, and (3) Curves.

Distance. Though there is considerable advantage in having a shortest possible route between two important termini, the element of *distance*, unless pronounced, is probably the least important of the primary physical factors. Slight detours to avoid heavy construction cost or for the purpose of reaching cities and towns are frequently more economical than a direct route, constructed without reference to topography or industrial considerations. To follow a water course regardless of the windings and detours was the natural route of early railroad construction. Not only were easy gradients thus obtained, but the established centers of population and of traffic were also reached along these natural channels of trade. It seems, therefore, that much of the large expenditures for "cut-offs," viaducts and tunnels to shorten lines are not economically justified. Such expenditures—caused largely by public demands or the rivalry of competing lines—are responsible in many instances for the diminishing rate of return on railroad capital. Railroad security holders, in consequence, have frequently undergone losses in thus promoting public convenience.

Grades. Grade is probably the principal feature of location affecting railroad operations. Steep

grades by increasing the resistance to be overcome by the locomotive have a pronounced effect on operating costs. When the incline of the roadbed rises but a few inches for each one hundred feet distance there is usually reduction of speed and an extra strain on the equipment. The use of additional locomotives to the train may be required. All this adds to the expense of fuel, wages and upkeep.

As the weakest link gauges the strength of a chain, so the steepest grade, (*i. e.*, the so-called *ruling grade*) restricts the size of the train and the maximum hauling power of a locomotive over a given stretch of line. If the slant downward is in the direction of the bulk of the traffic, the incline is a "*favorable grade*," since the hauling becomes a coasting operation. This is a decided advantage to economical operation and calls for no elimination of grade. A study of grades with reference to economical operation, therefore, requires a knowledge of the "*direction of the traffic.*" Both the Chesapeake & Ohio and the Norfolk & Western railroads have relatively heavy grades. As the freight carried is chiefly coal, mined in the Allegheny Mountains and shipped to Eastern tidewater or to the Ohio valley in the West, the grades are for the most part favorable. They do not interfere with heavy train loading. Similarly, heavy grades on branch lines having a small traffic are frequently of little consequence as a factor in operating efficiency. Their elimination accordingly is not economically justified if the expense will not

be sufficiently compensated by reduced operating costs.

The constant reduction of grades has been a prominent feature of American railway structural development. A quarter of a century ago a one per cent. (1%) grade was considered the inferior limit that economy of operation on any line required. But on many of the railroads having a heavy traffic a one per cent. grade is like a modern harbor channel only deep enough for sailing vessels. In fact, grade reduction has progressed to an extent that causes a query whether much of this expense is not waste. No one knows yet what it is worth to any road of a given character of traffic to reduce its grades to one-tenth of one per cent. *i. e.*, an incline of one foot for each 1000 feet of distance. A prominent railroad engineer,[1] placed the inferior limit at four-tenths of one per cent., but many of the companies have spent and are spending large sums in reducing grades as low as two-tenths of one per cent.[2] Is the capital thus invested wasted?

A low-grade line in competition with a line of heavier grades is generally held to have many advantages. To eliminate unfavorable grades, some companies justify the expense of relocating whole sections of line. Thus, the Atchison, in order to have a low-grade freight route over the Rockies, built a new line extending from Kansas City to

[1] Mr. Barry, in *Bulletin 49* of the Railway Maintenance of Way Association.

[2] See Walter Loring Webb in *Railway Age Gazette*, March 28, 1913.

Rio Puerco, a distance of approximately 1000 miles. The maximum grade on this division does not exceed six-tenths of one per cent. The Erie, likewise, has lately constructed a new low-grade line (the Genesee River Railroad) on its heavy traffic divisions between Hornell and Cuba, N. Y., which reduces the maximum grade from one per cent. to two-tenths of one per cent. This improvement, though costly, materially adds to transportation capacity and more economical operation.

Curves. Though affecting operating costs less than grades, curves are of no small consequence in the estimation of railroad physical qualities. Besides limiting speed of trains and lessening locomotive hauling power, curves cost more to maintain and to operate than straight stretches of track. They are also a fertile source of accidents. Curvature in railroad construction, therefore, is tolerated only because of the heavy cost of its elimination. The same economic considerations apply here as in the case of grades. Curve elimination should be in accord with traffic demands, and the capital expenditure thus incurred should not exceed a proper economic limit. This means that the resulting decreased operating costs or enlarged traffic capacity is to fully compensate for the cost of the curve elimination.

ROADBED AND SUPERSTRUCTURE

Physically a railroad is anything from a mud bank with two streaks of iron rust to a multi-tracked,

rock-ballasted steel highway equipped with contrivances for safety, speed, comfort and economy. The wide disparities in physical structure not only confine comparisons among railroads within very narrow limits, but also render difficult the adoption or establishment of proper and satisfactory standards for measuring the adequacy of transportation facilities or of efficiency methods. Many factors are to be considered in arriving at a basis of judgment in these matters, and the relative values of these factors are constantly changing. To describe in detail all physical features bearing on operation is manifestly uncalled for here. Attention is directed only to the main factors, data concerning which are contained in railroad reports and in statements filed with the Interstate Commerce Commission. These factors, considered in order, are (1) Track Facilities, (2) Rails, (3) Ties, (4) Ballast, (5) Bridges and Trestles, (6) Tunnels and (7) Terminal Facilities.

Track Facilities. Nearly all important railroads in the United States have the standard gauge track, *i. e.*, 4 feet 8½ inches width between the rails. The percentage of narrow gauge (*i. e.*, three feet width), on a few lines, however, is not a negligible factor. The Denver & Rio Grande had on June 30, 1912, 787 miles of narrow gauge road in operation of a total mileage of 2,597 miles. This is by far the largest ratio of narrow gauge mileage of any of the important railroad systems of the United States.

In the consideration of trackage, the "*miles of line*" should be clearly distinguished from the *miles*

of single track, or, to use another expression, "*total miles of track.*" The vast differences in the extra track facilities of American railroads, of itself, is sufficient to nullify the usefulness of a *per mile of line* unit for general comparative purposes. Extra tracks (second, third and fourth, etc.) entail additional capital expense and higher maintenance costs and, therefore, are expected to increase earning power. The proportion of extra main tracks has a direct relation to the amount of business done. Accordingly, companies handling relatively the same volume and character of traffic apparently require the same proportion of extra track mileage.[1]

Figuring on the needs of extra track facilities on the leading railroads can be reduced to somewhat of a mathematical certainty. On practically all lines, a schedule must be arranged to allow for trains running at different speeds going in the same direction as well as for trains passing in opposite directions on the same track. Delays of one train on a single track division caused by the taking on and the discharge of freight and passengers, or through accidents, entail a general "tie up." The resulting losses due to extra wages and fuel expense, idle equipment, freight congestion and the like, impair profits. Besides, there is the unfavorable effect of inconveniencing the public and lowering the character of the transportation service. All this

[1] There is a distinction between "extra main track" and "extra track." The former does not include sidings, spurs, and "yard "tracks, which are classified separately in the reports.

is bound to reduce the return on the invested capital. Whether such conditions can be remedied more economically by the construction of additional main track or through better management and higher operating efficiency is a problem which the railroad executive must consider. Competition and the relative ease with which funds can be obtained for betterment purposes have an important bearing on the problem. Capital expenditures for increased facilities, which are not urgently needed, as has already been pointed out, cause a reduction of the rate of return on the whole investment in the railroad property. On the other hand, a company with track facilities inadequate for its business will operate at a decided disadvantage in competition with lines better equipped. This arises in part from the well accepted theory that overtaxed facilities reverse the economic basis of railroad operation. Under such circumstances the transportation business is one of "decreasing returns" rather than of "increasing returns." In other words, *a railroad company that is handling traffic beyond its capacity will undergo additional costs proportionately greater than the revenues gained by the extra traffic.* This causes a decreased rate of profit on the whole business.

The position of the Wabash Railroad Company, during the years 1908–1912, may be taken as an illustration. Because of the financial losses involved in the acquisition of the Wabash-Pittsburgh Terminal Company, the Wabash's credit became impaired. It was thus unable to obtain capital for

the additional physical facilities demanded by its growing traffic. Consequently, in spite of enlarged gross earnings (which in 1911 were relatively about 20 per cent. greater than in 1905), the ratio of increase in expenses exceeded that of income. The company found difficulty in meeting bond interest requirements. A receivership and reorganization was the natural outcome.

The detrimental operating effects of inadequate track facilities may be further pointed out with reference to the Erie Railroad. Notwithstanding its large traffic expansion and its position as an important Eastern trunk line, the Erie because of inability to obtain capital on reasonable terms had been struggling along with approximately 300 miles of its main line a single track road. On one stretch of single track some fifty miles east of Chicago, the regular daily movement of business is reported to have included 700 loaded eastbound freight cars, 500 westbound loaded freight cars, and seven passenger trains each way. A freight train, no matter how profitable it might be, is invariably sidetracked for a passenger train. This means that it is held "idle" on a siding to let the passenger train pass. If the two trains happen to be going in the same direction the delay to the freight train may be only a few minutes; if they are going in opposite directions the freight train may lose an hour or more. If there is a "mishap," a half-day tie up may be the consequence. With 700 loaded cars and seven passenger trains going one way and 500 loaded cars

and seven passenger trains going another, (not counting work trains and trains of empty cars) there is little leeway for efficient and expeditious service or further traffic expansion. The losses on a single track road from unavoidable delays devour the increased revenue gained from additional business. In competing with the Baltimore & Ohio, the Pennsylvania and the New York Central (having two, four and six-track lines), the Erie, from the viewpoint of operating economy has been like a man fighting with one hand tied behind him. If, as is reported, a second track normally increases the possible efficiency of a road 120 per cent. the Erie operating management in the last decade has been distinctly creditable. With its insufficient extra track equipment the company handled in proportion to its mileage more freight business than the New York Central System which has four tracks all the way from New York to Chicago. But has the Erie been able to serve as well the needs of the shipper and the public at as low a cost as is possible under the best operating conditions? This is the problem. Railroad earning power rests not alone on performing the transportation service, but performing it efficiently and economically.

In comparing the track facilities of different railroads in relation to traffic, account must be taken of the relative proportions of *main line* and *branch line* mileage. Branches and "feeders," as a rule, have a smaller traffic than the main lines. Accordingly the need for extra track is not so pronounced.

Caution is required, however, in the definition of branch lines. These on some railroads have a heavier traffic than main line mileage on other systems. The absence of standardization renders comparisons exceedingly difficult.

Rails. A fairly large number of railroads report the quality and character of the rails in the tracks. Rail facilities are measured by weight. This may range from 50 to 110 pounds *per yard length.* For ordinary service on the main line of a modern railroad system a 75 pound rail, is generally the minimum weight that can be safely used. With the constant tendency toward heavier rolling stock and greater speed, an 85 pound rail is fast becoming the standard. Taking the progress of the Norfolk & Western Railroad as typical, we find that on June 30, 1898, of a total of 1,496 miles of main track, over 1,206 or slightly more than 80 per cent. had rails of 67 pounds per yard or under. On June 30, 1911, however,—thirteen years later,—the 67 pound rail had very nearly disappeared and more than 80 per cent. of main track was laid with 85 pound rails. There was, in addition, about 196 miles having 100 pound rails. Because of enlarged traffic and heavier equipment, the light weight rails are constantly displaced by a heavier and more durable quality.

Weight of rails in all cases should be properly adjusted to the traffic and to the size of the equipment which is to pass over them. The mere statement that one company has a larger proportion of heavy rails than another, even though the business handled

is similar, is of no consequence unless a correct distinction is made between branch line and main line mileage. The fact that the Kansas City Southern has a smaller percentage of light weight rails, (*i. e.*, under 75 pounds to the yard) than the Southern Railway or the "Frisco," is probably due to the former's small amount of branch mileage relative to that of the other two systems. In each instance the information desired is whether the character of rails on every section of track is best suited to the traffic.

Use of rail statistics as contained in the railroad annual reports is best applied in the analysis of progressive physical betterment. An increase in the proportion of heavy to light weight rails from year to year usually indicates progress both in volume of traffic and in the facilities for handling same.

Although a standard quality of steel rail has been adopted in the United States, the leading railroad companies because of the use of heavier locomotives and cars, and because of larger train-loads and increased speed in both passenger and freight service are requiring a superior quality of rail designed for safety and durability. Serious accidents result from broken rails caused by "crystallization" or by excessive strain. Some progress in rail betterment has been made through the substitution of the "Open Hearth" for the "Bessemer" rail. The former contains less phosphorus than the "Bessemer" rail and is, therefore, less liable to "crystallize." It also can be more readily "alloyed" with other metals and

chemicals for improving quality and durability. Much experimentation is yet necessary to afford a standard adapted to all the needs of modern railroad operation.[1]

No definite rule can be followed as to the proper rate of rail renewals on a railroad system. Deterioration, wear and tear and breakage are affected by many factors besides the volume of traffic. Climate, for example, is a potent factor. On some of the Eastern trunk lines an 85 pound standard rail is said to have an average life of from ten to fifteen years. At the end of this time the rail is not worthless. It can be taken up and placed on a branch line or on a siding. On some of the larger systems (the

[1] Statistics showing the quality and weight of rails in main tracks of American Railroads, January 1, 1912, according to a special committee of the American Railway Association, are as follows:

Rail in Main Track

	Bessemer	*Open Hearth*	*Special Alloy*	*Total*
Per cent	87.47	11.43	1.10	100.00

	Per cent.
100 pounds and upward	5.845
90 pounds and less than 100	8.324
80 pounds and less than 90	32.941
75 pounds and less than 80	12.809
70 pounds and less than 75	8.564
60 pounds and less than 70	18.158
Less than 60 pounds; Mixed; Unknown	13.314
Iron	.045
Total	100.00

Union Pacific for example), it is the practice to re-roll heavy, worn-out rails for use on branches requiring only light weight rails. The period of usefulness is thus extended and at the same time the quality of the rail is improved through re-rolling.

Wrecks from broken and worn-out rails are costly accidents. The question of rail maintenance, therefore, is important both to railroad investors and to the travelling public. Some indication of what is being done in this matter may be had by a comparison of rail renewals of individual companies from year to year, expressed in tons; not neglecting the expansion that may have taken place in the track mileage or in the amount of business passing over each mile. It should also be borne in mind that with improvement in rail quality and durability, the rate of renewals will consequently decline.[1]

Ballast. The requirements of a strong, firmly fastened track on a solid roadbed to accommodate loaded modern railroad equipment magnifies the importance of ballast as a physical factor in eco-

[1] The tonnage of new rails actually used by the Pennsylvania Railroad has been as follows:

1912	153,693	1907	149,878
1911	111,799	1906	163,797
1910	162,790	1905	128,075
1909	137,665	1904	110,591
1908	31,563	1903	156,522

This record shows that the company uses the maximum of rails in the years of heavy traffic (1903, 1906, 1910), and the minimum in years of industrial depression (1904, 1908, and 1911).

nomical railroad operation. The materials used for ballast range from ordinary soil to sand, cinder, burnt clay and broken granite rock. The geology of the territory traversed by a railroad system frequently determines the ballast material rather than the volume of traffic handled or the general maintenance policy of the management. To haul ballast a long distance adds greatly to its cost. Hence, a railroad in a region of poor ballasting materials may use an inferior product as most economical, even though there is heavy expense of upkeep because of frequent renewal. The Union Pacific, for example, is very heavily ballasted with Sherman gravel, a disintegrated rock, possibly the finest material for the purpose in the United States. Moreover, because of its availability to some of the Union Pacific lines, it is relatively cheap. The Chicago & North Western, on the other hand, is rather lightly ballasted with gravel, sand and other materials of inferior quality because of the poor geological resources of the prairies traversed. Similarly, the Canadian Pacific, from Montreal to Quebec, a distance of 178 miles, is largely ballasted with sand, the only material economically available. These differences in conditions are naturally reflected both in construction and in maintenance costs. These costs, when sufficiently accounted for, should not mislead the railroad analyst.

A few railroad companies publish statistics of the depth as well as of the constituent of ballast. This information, however, can be interpreted properly

only in connection with the size of the ties and their average distance apart in the track. The kind of material used has no necessary relation to the depth of the ballast. In practice, however, stone ballast generally has a less depth than gravel or other light material. This is probably due to the higher cost of stone.

Ties. In view of the constant upward trend of lumber prices, tie economy has become one of the most fruitful means of keeping down track maintenance costs. Naturally, a high speed track with heavy traffic requires better ties than a track with light trains, but it does not necessarily follow that a much used track requires more frequent tie renewals. The question of the maintenance lies in the natural decay of the tie. On a carefully ballasted, well drained track, notwithstanding heavy usage, decay will not be as rapid as on a badly ballasted, improperly drained track. Thus the length of life of a tie depends, (a) on its quality (*i. e.*, whether cypress, oak or pine), (b) whether "treated" (*i. e.*, prepared with creosote or other decay-resisting chemicals) and (c) the care with which it is placed and maintained in the roadbed. Very few railroads furnish a clear statement of the quality of the ties or of the amount of tie renewals. Though probably not as important in gauging railroad physical characteristics as rails, well-kept ties are essential to efficient and economical transportation service. Furthermore, tie renewal cost constitutes the largest single item among track-materials costs. Wooden

ties of good quality (cypress and oak) have become so costly that some companies are endeavoring to substitute other materials, such as steel and concrete. Experiments along these lines have not been advanced sufficiently to permit proper judgment as to the propriety of ultimately replacing wooden ties.

The distribution of the various grades of ties—*hard wood* and *soft wood, treated* and *untreated*—over a large railroad system should be adjusted so that each grade will give the most economical service. Similarly, the keeping of accurate and complete tie renewal records to eliminate waste and double haul on ties supplied in excess of requirements can effect a considerable saving in tie maintenance expense. The engineering departments of some railroads have made a careful study of this problem and now have in operation schedules of tie distribution. The selection of one class of tie rather than another on a given division depends on the climate, the traffic, the weight of rail, the depth and kind of ballast, the use of tie-plates and fastenings and the location of the line with reference to the tie supply.

Bridges and Trestles. Bridges and trestles, as elements in railroad operation, limit the size, weight and speed of trains in much the same way as grades and curves. A "weak" bridge on a line of heavy traffic may necessitate the "breaking-up" of trains or the slowing down in speed, both of which add materially to operating expenses. Moreover, the frequent burdening of a structure with its maximum

bearing capacity produces stresses that may lead to breakdowns and wrecks. These are costly accidents in the business of rail transportation. Thus, the material and quality of bridges and trestles are prime factors in economical railroad operation. The tendency toward betterment and improvement in bridge construction should be carefully considered. The replacement of obsolete bridges and trestles by stronger and more durable structures is as pertinent to railroad economic progress as larger revenues and greater net earnings.

The original timber trestle bridges, where they still exist, are on most lines a survival of a by-gone era. Their first substitutes of iron or steel seem also to be doomed to give way to structures better able to bear the stress of the ponderous locomotives and long trains of gigantic freight cars that are now becoming standard rolling stock. Unless bridges are carefully strengthened or replaced with new structures, suitable to the weight of heavy rolling equipment, a single accident may cause greater expense than the precautionary outlay would entail. Railroad engineers, therefore, fully alive to this contingency, are endeavoring to determine the reasonable limits of capacity bridges should be required to show beyond the weight of the heaviest trains passing over them. Important data in this connection have been compiled by the American Railway Engineering Association. This information is of great service in successful railroad construction and operation.

Tunnels. The relation of tunnels to operating costs is not so apparent as in the case of bridges and trestles. Yet, aside from the higher cost of tunnel maintenance as compared to that of "open cuts," no other physical feature limits so effectively transportation capacity or leads so much to traffic congestion. Moreover, the construction of tunnels is exceedingly costly. Intelligent railroad engineers plan to do without them as much as possible. They are built and tolerated to avoid either a wide detour or an extremely costly "open cut."

A good example of tunnel construction limiting transportation capacity and adding greatly to operating costs is the old Bergen Hill Tunnel of the Erie Railroad. When this was built its two track width and other structural qualities were regarded as sufficient to accommodate the maximum traffic that the company was capable of developing. In a few decades, however, growth of business at the New York terminal demanded larger track facilities. Because of the impracticability of enlarging the Bergen Tunnel, these could not be built. The result was that, aside from the relatively heavier operating costs due to traffic congestion, the Erie could not furnish the same standard of transportation service at its Eastern terminal as competitors. Finally, at heavy capital cost and with much difficulty, a wholly new "cut-off" was built to get rid of the "Bergen nuisance."

Railroad Terminals. Terminal facilities are an element in economic railroad operation that is fre-

quently overlooked. The necessity of having stations and depots at centers of population and of industry to retain and promote traffic is fully recognized by capable railroad executives who justify the vast expenditures for enlarged and improved terminals on this ground.[1] The large expense of acquiring terminal property, in fact, is largely responsible for much of the recent heavy increases in railroad capitalization.

Aside from improper location, however, a railroad company may suffer many disadvantages from inadequacy of terminal facilities. The expense of handling traffic at terminals is a large though ill-defined item in railroad operating costs. This expense is greatly augmented through over-crowded yards and stations, or through insufficient and obsolete terminal equipment. As has already been pointed out, whenever larger business is received than can be conveniently accommodated, the operating costs increase in greater proportion than the enlarged revenues until a trend of "diminishing returns" is reached. If unabated, this condition may prove disastrous to the interests of the stockholders.

The difficulty in the way of proper railroad terminals, as already stated on page 94, is the heavy cost of acquiring urban property. Development of the country has produced great cities, where land has risen to very high values. At the same time,

[1] Mr. A. M. Wellington in his treatise on "Railway Location," (p. 64) places the loss of revenue of a railroad for each mile a terminal or station is distant from the center of traffic at from 10% to 25%.

it has produced a vast increase of railroad traffic at these centers. All this necessitates larger urban terminals, aside from the additional tracks and safety devices required by the denser traffic. Could this larger volume of traffic be handled without additional tracks and terminals, a substantial reduction would result in railroad operating costs. Much of the economy in operations outside of terminals, effected by doubling tracks, strengthening bridges and installing block signals and the like, are undoubtedly swallowed up by the enormous cost of new city terminals necessary for the handling of the greater traffic. A railroad cannot handle well the business of 100,000,000 tons annually with terminals built and equipped to accommodate the handling of but 60,000,000 tons.

Railroad expansion, by stimulating the growth of great cities, has caused an enormous enhancement of property values. Accordingly some railroads now find themselves compelled to buy property for enlarged terminals at the enhanced values which they have largely created. The Pennsylvania has spent over $100,000,000 on its tunnels and terminals in New York City and is about to incur similar expense in Philadelphia. The New York Central has been driven to make expenditures exceeding $75,000,000 in New York City. Developments of the same kind are taking place in Chicago. The Wabash Railroad, figuratively, broke its back in acquiring Pittsburgh terminals at heavy cost.

Besides the general terminal facilities in the way

of freight and passenger stations, railroads nowadays must supply, when required, a great many special facilities for different industries. It is common for the leading transportation companies to own their own piers and docks and to give direct wharfage to steamship lines in order to secure their business. These dockage facilities are in some cases invaluable assets, the loss of which would mean financial ruin. Besides piers and yards, storage facilities, such as elevators and warehouses, must likewise be supplied when required, not only at tide water, but also at interior points. These facilities are frequently for the roads' own protection, since car shortages may be caused by the failure of shippers or of connecting steamship companies to remove freight consigned to them. In addition to storage conveniences, special accommodations must be provided for the transhipment of coal, iron ore, and other bulky commodities which are moved in large enough quantities to furnish a motive for economical handling. It is through these specialized facilities that competing lines arm themselves in the struggle for business, to say nothing of the saving in operating costs which are thereby effected.

CHAPTER VI

PHYSICAL FACTORS IN ECONOMIC OPERATION: RAILROAD ROLLING EQUIPMENT

Improvement in the character of rolling stock has been coincident with improvement of roadbed and superstructure. Progress along these lines has been so rapid that it is exceedingly difficult to maintain a satisfactory standard unit for measuring railroad equipment facilities. Railroads differ as to their rolling stock to an even greater degree than in track or roadbed. Moreover, on almost all railroad systems there is in active service equipment representing the different types in the progress of the last two generations. As one type becomes obsolete for the highest grade service, it is not wholly discarded though relegated to an inferior use.[1] One of the greatest expenses of American railroads is this constant replacement of obsolete equipment to meet the public demand for better service.

Locomotives. In view of the steady progress in the size and quality of railroad equipment a mere enumeration of the locomotives in relation to the volume of traffic is no index to adequacy of motive power.

[1] Thus, in 1910 the locomotive of the New York Central Railroad, No. 999, that but a few years before hauled the famous Empire State Express, was pulling a milk train in Northern New York.

A pronounced increase in the size of engines on some railroad systems, though resulting in numerical reduction, may mean a larger hauling capacity than on another system possessing a greater number of locomotives. The most advanced type in locomotive construction (the Mallet articulated compound locomotive) is essentially a *double engine*, and, because of its structural advantages, has greater power than two ordinary single-expansion type locomotives.

How immensely the weight of a locomotive has increased may be judged from the fact that there are now in use engines of the 24-wheel type, weighing 600,000 lbs., and over. When the first bridge was built for carrying trains, about 1835, the four-wheel grasshopper type of engine weighed less than 22,000 lbs. It was 1873 before a consolidation type of locomotive reached the weight of 100,000 lbs.; in 1895 the maximum of 200,000 lbs. was reached. The increase above 400,000 lbs. has come within the new century. It need hardly be repeated that roadbed, rails and bridges have been correspondingly strengthened to support this equipment.

The great increase in the size of locomotives has largely augmented the hauling capacity of the railroads, though in recent years the number of locomotives built has been less than formerly. One type of engine has followed another so rapidly, with constantly increasing weights, that there seems to be no limit to the possible weight of a locomotive. It is not so many years ago that this weight seemed to be restricted because the permissible weight per

foot of track was necessarily limited, while the length appeared to be limited on account of the radii of existing curves. The appearance of the Mallet type, with compound articulated boilers, however, permitted the locomotive to be elongated beyond what had formerly been regarded as the maximum. Much of the growth in railroad traffic therefore, has been taken care of by larger and more powerful locomotives rather than an increase in the number of engines.

Because of the great variety of locomotive types railroad motive power is not measured by available locomotives, but by *tractive power* pounds. The *tractive power* is the final pulling force that the engine is capable of exerting. It is defined by Wellington as being limited by the percentage of adhesion to the track. Motion causes slipping which reduces percentage of adhesion. The maximum percentage of adhesion that can be maintained relative to weight on driving wheels while in motion is the *total tractive power*. Expressed in pounds this is the theoretical measure of locomotive capacity while in operation. It is dependent on the locomotive weight on the driving wheels and on the boiler and cylinder power of the engine.

The actual capacity of a locomotive, however, depends not only upon its size but also upon its efficiency for the service to which it is adapted. In fast passenger service, for example, the efficiency test occurs when the locomotive is developing a comparatively low tractive force at high speed.

Under these circumstances the hauling power depends primarily on the steaming capacity of the boiler, and not upon the weight carried by the driving wheels. In heavy, slow freight service, the conditions are different. Here the test comes when the locomotive is ascending a grade at slow speed, and developing a high tractive force. The ability to haul the train thus depends upon the weight carried on the driving wheels as well as upon the boiler power, and an increase in hauling capacity can be secured only by enlarging the locomotive and placing more weight on the driving wheels. In this way a higher tractive force can be developed.

Since the tractive power of freight locomotives, while in motion, varies with the percentage of adhesion of the driving wheels to the tracks, the alignment of the roadbed and the speed required by the service are just as important factors in determining the required hauling power of locomotives as the volume and the character of the traffic. Locomotives of high tractive power, such as the Mallet compound type, maintain their pulling force near the maximum only at moderate speed. Hence, they have not become useful for passenger and for fast freight service. Railroads with heavy grades, and the coal and ore carrying roads on which speed is not a factor, find it economical to use large and powerful locomotives of the Mallet type. The high tractive power permits large train loads without the inconvenience and expense of employing "helper" locomotives, or "double headers."

The choice of locomotive types is not based alone on hauling capacity and speed efficiency. Economies that may be effected in fuel and in maintenance cost are likewise important factors. Thus, on one division of the New York Central, where the traffic consists largely of coal, consolidation locomotives formerly used have been displaced by less than half the number of Mallet compound engines which handle the business more efficiently with a saving of 35 per cent. in fuel consumption per mile. Inasmuch as these matters can be determined only by actual test and experiment, the efficiency of the railroad management determines in each case the proper selection of locomotive types. The fundamental principle of sound business enterprise demands that *the equipment should be neither more nor less than required to move the traffic in an economical and efficient manner.* Anything else is wasteful.

On American railroads, it is the practice to give each freight locomotive a "rating" of the maximum tonnage it can haul over a stretch of line. This rating is gauged according to the character of the freight, the speed at which it is to be moved, and the prevailing weather conditions. Locomotives therefore can be so distributed for use over a railroad system that each can be worked to full capacity while in service. The locomotive on an economically managed road is expected to be earning money every moment that it is not in the hands of the roundhouse or of the repair men.

Although enlargement of locomotive tractive

power has been rapid in recent years, the weight of the modern locomotive cannot advance much further except at the expense of extensive improvements in alignment and track, or possibly through the adoption of an arrangement of wheels which will permit the weight to be much more widely distributed than at present. Taking for illustration the Mallet type, which is now acknowledged as best suited to dense traffic, it may properly be asked how far may this machine be made more efficient by other means than by increase in size. Further contrivances such as compounding cylinders and steam superheaters, already largely in use, are required to offset the tendencies toward higher wages and material costs. All these matters are important elements in profitable railroad operations.

Cars. The difficulty in measuring the adequacy of car facilities is much the same as that of locomotive power. Railroad cars, both passenger and freight, even when separately considered in classes, differ in original cost and in expense of upkeep as well as in size, in use, and in durability. Accordingly, to compare the car facilities of different railroads by mere enumeration of each class (*i. e.*, box, flat, gondola, etc.), frequently leads to erroneous conclusions. No clue is given to the ultimate carrying capacity. By *car capacity* is meant the amount, in terms of weight, that can be loaded into a freight car or the number of passengers that can be seated in a passenger car. The capacity of any given car, therefore, depends first, on the strength and quality of the car and,

secondly, on the character of the traffic for which the car is designed. Thus, heavy and dense commodities, such as iron ore, coal or grain, may be loaded to the full marked capacity when the car is built of strong material, whereas, when loaded with light and bulky articles such as furniture, the same car cannot accommodate one-third of the weight. Moreover, certain freight because of the extreme size of each piece (*e. g.*, automobiles) or because of perishableness (*e. g.*, fruits) cannot be economically loaded without leaving considerable unoccupied space. A company that employs cars double the capacity necessary for the class of goods to which they are adapted is as uneconomical as one that uses small, antiquated and broken-down equipment for bulky and dense commodities. Car capacity, therefore, when apportioned in each case to accommodate the volume of the different classes of commodities moved on each system, is an important element in efficient railroad operation.

The growth in heavy bulk shipments of freight has led to the use of larger and stronger cars. The average carrying capacity of a box car in 1871 was, approximately, 10 tons, or 20,000 pounds. Eight or ten years later a movement began to increase the maximum load to 15 tons and even to 20 tons. On June 30, 1902, according to the returns of the Interstate Commerce Commission, the average carrying capacity of a box car on all railroads in the United States was 27 tons. In 1908 this had increased to 32 tons. The average capacity of box

cars in 1912 was 34 tons or more than three times as much as in 1871.

The same growth has characterized the American passenger car. From a length of between 40 feet and 50 feet, it has increased to 75 feet and to 80 feet, and with the increase in length has come a more than corresponding increase of weight. The seating capacity of an ordinary day coach 70 feet long is about 88 passengers, and its weight is about 135,000 lbs.

Improvements in the materials of car construction have gone hand in hand with enlarged carrying capacity. The old wooden box car is fast disappearing and doubtless some day will be as little used as the iron rail. Railroads now demand all steel or steel underframe cars. According to the *Railroad Age Gazette*, 88 per cent. of the freight cars built in the United States in 1910 were of steel or steel underframe construction, whereas, in 1907, these were but 72 per cent. of the total. The figures for passenger car construction for 1911 show that 909 all steel cars were built; 619 were built with steel underframes and 1,010 were of wooden construction. The probability is that within a few years the all steel passenger car will take the lead.

The primary reason for using steel passenger cars is to ensure that they shall stand up under the strains incidental to very high speeds. High speed increases the danger to life and limb due to a derailment. Steel cars, moreover, minimize the dangers from fire in wrecks or while passing through tunnels.

The use of steel in the place of wood, therefore, may result in large savings to the railroads.

The use of heavier materials for car construction introduces the element of "dead weight" as partly offsetting economy from increased car capacity. The common passenger car has been made larger and stronger, until now it is estimated to weigh eleven times as much as the passengers it carries. This, however, is the proportion in the case of a car which is fully loaded. But on the luxurious trains on which the number of passengers is usually not over 100, the passenger weight is probably not more than one per cent. of the weight of the car. All this has an important bearing on operating costs, since the size and tractive power of locomotives must be increased to haul the extra "dead weight", or the number of cars per train must be reduced.

The problem of increase in "dead weight," is also becoming a factor in freight operations. An 80,000 pound capacity box car with a steel underframe weighs about 45,000 pounds, whereas, a plain wooden car of the same type of 40,000 pounds capacity, weighs about 30,000 pounds. Hence, an increase of 100 per cent. in carrying capacity is accompanied by 50 per cent. increase in "dead weight." However, as long as the "dead weight" per unit shipment is not enlarged in the same ratio as the carrying capacity there is manifestly a direct operating economy in using larger and stronger cars, provided there is tonnage for full loading. In the event, however, that "dead weight" outstrips growth in carrying

capacity, heavy materials for car construction can be economically justified only on the ground of greater durability and smaller upkeep expense.

Because of the general practice in railroad operations of inter-company car hiring, considerable progress has been made in the standardization of freight cars. The American freight car is a wanderer from home. For months, and even for years at a time it may be on the tracks of another company, journeying up and down over the face of the continent. If it breaks down while thus "hired out" it must be repaired. In order to avoid delay the repair parts must be those with which the mechanics on all lines are familiar and which can be readily obtained. The Master Car Builders' Association, which controls the practices governing the interchange of cars, has formulated specifications of standard parts relating to car construction. These parts include journal-boxes, brasses, axles, wheels, brakeshoes, safety appliances and the like, adapted to various types and capacities of cars. These are generally used by all of the railroads of the country. The wide interchange of cars that is practiced becomes possible only by their strict observance.

To have a supply of both freight and passenger cars on hand to meet the maximum traffic demands at all times is an exceedingly important factor in a railroad's earning capacity. Aside from public inconvenience, a "car shortage" on a railroad system implies inefficiency of management and inability to take advantage of the maximum revenue that it is

capable of receiving. The supply and the capacity of equipment on hand, therefore, is an item deserving careful observation. A railroad company which is compelled to use an unduly large proportion of "hired" equipment may have a temporary advantage, in that it can surrender the foreign cars during dull seasons, but the hiring expense and the delays encountered before the equipment can be returned frequently over-balance the gain. Moreover, during the busy season, "foreign" cars are not readily obtainable, unless they have been stored on the hiring company's side-tracks in anticipation of the demand. During this time the per diem rental must be paid on the idle equipment. To prevent abuses of the car hire privilege, the per diem rental rate enforced by the American Railway Association for interchanged freight cars was increased on January 1, 1913, from 30c and 35c to 45c. This rental is exclusive of certain repair expenses which are charged to the hiring company.

The question of adequate and proper equipment in connection with well constructed and efficiently maintained roadbed and superstructure is worthy of careful study by both railroad managers and security holders. Data of this sort may be more indicative of financial progress and investment stability than the figures of operating revenues and net income.

CHAPTER VII

TRAFFIC STATISTICS

Passenger and Freight Traffic. The distinctive traffic feature of American railroads is the predominance of freight over passenger business. According to latest statistics of the Interstate Commerce Commission only 23 per cent. of railroad operating revenues came from passengers, whereas more than 68 per cent. was obtained from freight. There is a great divergence from this proportion on some of the Eastern lines. The New York, New Haven & Hartford, the New York Central, the Long Island Railroad and others having a large suburban business and traversing densely populated sections have a passenger revenue very nearly equal to or in excess of freight earnings. Thus, the New York, New Haven & Hartford passenger revenue for the fiscal year 1911 was 86 per cent. of freight revenue. The New York Central, for the same year, had passenger earnings approximately 31 per cent. of the total operating revenues. This ratio is proportionately greater than on the Erie, the Baltimore & Ohio and the Pennsylvania. In the West and South, railroads depend very little on passenger business. The Union Pacific passenger earnings for the five years ended June 30, 1913, never exceeded 25 per cent. of gross oper-

ating revenues, and on the Northern Pacific and the Southern Pacific it has not been very different.

The economic effects of these disparities in the proportion of passenger to freight earnings should not be overlooked. It is very generally conceded, though difficult of practical demonstration, that railroad passenger traffic, as a whole, is not remunerative. Of course, the railroad systems that have a large passenger business may gain more per unit of passenger traffic than the lines whose revenues come almost entirely from freight. This particularly applies to lines having facilities adapted to large passenger business, for then the traffic is one of "increasing returns," *i. e.*, the total cost of operation increases in less proportion than the increase in the traffic units. In any event, as long as the revenue obtained from additional passenger traffic covers the expenses caused directly by this new business (other things being equal), no loss can be said to result from increase in passenger service. However, passenger rates are not constructed or adjusted after the manner of freight rates. Hence, railroad systems having dense passenger business are not statistically comparable with those whose operating revenues are derived almost exclusively from freight service.

In view of the predominance of the freight business of American railroads, our attention in the study of traffic statistics shall be devoted almost exclusively to this class of transportation service.

Classification of Traffic Statistics. For purposes of analysis traffic statistics may be grouped under two main categories:

1. Those indicating the nature of the traffic, *i. e.*, the volume and the classes of freight and the number and kinds of passengers carried.

2. Those indicating efficiency and economy in conducting the transportation service.

THE MEASUREMENT OF VOLUME AND CLASS OF TRAFFIC

Herein are included all data dealing with

(*a*) the classes and kinds of commodities carried,

(*b*) the average rate received for each and all classes,

(*c*) the average density of the traffic, and

(*d*) the average distance each unit is conveyed.

Obviously, over these matters the railroad managers have very little direct control. A railroad is compelled to accept for transportation the kind of freight offered and to convey this freight to a designated station on its lines, or, when the point of destination is not on its own lines, to a convenient transfer station. The compensation received for each class and kind of service is, as we have already pointed out, determined largely by competitive and economic forces. Each factor—*class of commodity, weight, length of haul,* and *rate*—affects earning power. It is for this reason that the details of these factors are so carefully collected and analyzed and that the so-called "*ton-mile*" and "*passenger-mile*" statistics

have been developed. The resulting data are alike useful to railroad managers, to investors and to the public. "The system of statistics based upon the ton-mile and the passenger-mile," says a British Parliamentary Report,[1] "takes as its foundation the principle of combining in a comprehensive figure the two factors of weight or number and of distance. . . . The fundamental units, (the *ton-mile* and the *passenger-mile*) being, respectively, one ton carried one mile or one passenger carried one mile."

The Ton-mile Averages. The fundamental traffic units are employed as averages. It is the characteristic of the average to give no information of the differences and disparities of the individual units on which it is based. Almost any person may have a fairly definite conception of what is meant by a ton of coal. How many can form a mental composite picture of a ton of meat, a ton of cotton, a ton of salt, a ton of rice, a ton of sugar and a ton of silk? *The ton-mile gives no indication of the classes and kinds of commodities carried, the character of the service rendered or the gross receipts and rate received from each class.* It covers all kinds of traffic, both "through" and "local," as well as "high grade" and "low grade." One railroad, let us say, has a large fruit and vegetable traffic which it hauls all the way from California to the Atlantic States. Another carries coal, sand and iron ore, all bulky articles that are

[1] "Accounts and Statistical Returns of Railway Companies,"—Report of the Committee Appointed by the Board of Trade (1909) cd. 4697.

hauled but a short distance. In the first case the haul is long and the rate received per ton is high. In the second case, the rate is low and the haul is short not only because a high standard of transportation service is not essential but also because the large bulk of the commodities in relation to their low monetary value places an economic maximum limit on the freight charge that enters into their market price. *Accordingly, in every summaried statistical presentation of railroad traffic full consideration should be given to the relative proportions of the various classes of commodities carried.*

Classification of Commodity Traffic. The Interstate Commerce Commission, for a number of years, has classified railroad freight tonnage as, *Products of Agriculture, Products of Animals, Products of Mines, Products of Forests, Manufactures, Merchandise and Miscellaneous.* This classification is generally followed in the presentation of freight commodity statistics in railroad reports. With the exception of merchandise, the classes comprise only carload shipments. It is evident that, although in some instances the requirements of a general comparison are met with in this classification, the wide disparities among the commodities within each class preclude a correct indication of the real character or of the profitableness of the group. Thus, the Atchison's freight traffic consists of about 22 per cent. in agricultural products, of which fruit and vegetables are about one-fourth. Measured by receipts, however, and probably by profits, the

fruit business is a very much larger proportion. Similarly, dressed meats are included under *Products of Animals*, along with live stock, hides, bone fertilizer and the like. The length of the haul as well as the receipts per ton-mile of dressed meats, however, is far in excess of the average for all commodities in the group.

Essential to correct measurement of railroad traffic is a knowledge of the relative proportions of *carload* and *less-than-carload freight.* Some classes of commodities are almost uniformly shipped in carload lots. Many other commodities are generally forwarded in small bulk or "less-than-carload" lots, (L. C. L. freight). The consuming capacity of the territory traversed frequently determines in how far a railroad company can enjoy carload lot shipments. Accordingly, two railroad systems traversing different localities, though carrying the same proportions of similar commodities, may sustain wide differences in the average rate and the net profit received from the same class of freight. In the case of carload shipments, the freight rate on a *ton-mile* basis, largely because of economies in handling, is naturally less than when the same commodity is shipped as a *less-than-carload* lot. The profit on carload shipments to the railroad, however, may be relatively greater.

No important railroad system as yet furnishes stockholders data regarding the proportion or the rate per ton-mile of each class of commodity shipped in carload lots. The Interstate Commerce Commis-

sion, however, requires in the official annual report filed by railroads, a statement of the tonnage, ton-mileage and revenue from certain selected commodities transported in carload lots. Among the commodities selected are grain, hay, cotton, live stock, dressed meats, anthracite coal, bituminous coal and lumber. This data pertaining to individual railroads is not published, but the original report filed by each company with the Commission is available for public inspection at Washington.

Diversification of Traffic. A railroad system may be largely dependent for revenue on one class or kind of commodity, or it may have a *diversified traffic*, *i. e.*, one class of freight is not disproportionately large or small. In no instance does each class of freight bear the same proportion to the total or contribute alike to the revenue. Certain commodities enter more largely into freight movement than others not only by reason of their limited areas of production and widespread demand but also because transportation is an essential element in the preparation for their consumption. Moreover, raw materials and bulky articles, such as mine and forest products, naturally tend to outweigh lighter products. It is, therefore, logical that mineral products make up more than one-half of the total freight movement in the United States. It must be remembered, however, that the average distance these bulky products are hauled is comparatively short. Their importance to the railroads, therefore, though undoubtedly very great, is unduly emphasized in a

statement showing merely the percentage that each class of freight bears to the total tonnage.

A diversified tonnage is generally considered more favorable to earning stability than traffic consisting almost exclusively of one commodity. Yet, the construction and development of many leading railroad systems has been due to the large revenue afforded by some important commodity requiring transportation facilities for ultimate consumption. Thus, the heavy coal tonnage of the "Anthracite" and the "Bituminous" roads, and the "ore" tonnage of lines from Lake Erie to Pittsburgh, in connection with other freight movement, furnishes these railroads a heavy business which is conducive to low operating costs per traffic unit. Fluctuations in the predominant item of tonnage, however, occasionally impair the earnings of these companies. Stability of earning power is a principal source of financial security. Hence, every railroad management aims to acquire as diversified tonnage as may be possible in the territory traversed.

A further disadvantage of lack of diversified tonnage is the large movement of traffic in one direction. This necessitates the extra expense of the "back haul" of empty cars. In some cases a "return tonnage" has been developed to offset this expense. Thus, the ore carrying lines supplying the Pittsburgh district have a return tonnage of coal to the lakes. Similarly, the Delaware, Lackawanna & Western, in more respects than one a "Road of Anthracite," has succeeded in building up a large

fruit traffic over its line from the seaboard to interior points. Even though this equalization of traffic flow may not eliminate or reduce the hauling of empty cars, it, at least, avoids the necessity of trains made up exclusively of "empties."

The effect of diversified traffic on Eastern lines in reducing the percentage of empty car to the total car movement is fairly indicated in the following table compiled from returns submitted to the Interstate Commerce Commission for the fiscal years 1910, 1911, and 1912:

Company	*Percentage of empty car movement to total car movement*		
	1912	*1911*	*1910*
	%	%	%
Philadelphia & Reading	37	38	40
Central Railroad of New Jersey	40	41	40
Norfolk & Western	40	41	39
Chesapeake & Ohio	37	38	38
Lehigh Valley	33	31	32
New York Central, etc.	34	34	33
Erie Railroad	31	30	29
New York, New Haven & Hartford	32	32	31
Boston & Maine	28	21	27

The four companies reporting the highest percentage of empty car movement in the above table are those which, besides having a large coal tonnage, have no special facilities for interchange of through traffic with connecting lines. The Erie and the Lehigh are both "Anthracite" lines, but the Erie

is also a trunk line from Chicago to New York and the Lehigh has an arrangement for interchange of through traffic with the Grand Trunk at Buffalo. Traffic interchange affords an opportunity for diversification of tonnage and reduction of "empties."

An instance of improved diversification through gradual change in the relative proportions of each class of freight tonnage is furnished by the Atchison, Topeka and Santa Fé System:

Year ended June 30th	*Per cent. to total tonnage*				
	1901	*1904*	*1908*	*1911*	*1912*
	%	%	%	%	%
Grain Products	18.82	16.46	9.20	7.50	6.85
Other Agricultural Products	12.05	12.50	13.68	14.83	15.33
Products of Animals	10.03	8.99	7.92	7.74	7.33
Products of Mines	30.94	30.06	32.05	28.36	30.95
Products of Forests	7.98	12.28	12.41	11.11	10.24
Manufactures and Merchandise	20.18	19.71	24.74	30.46	29.30
	100.00	100.00	100.00	100.00	100.00
Freight receipts per ton-mile	1.007c	1.002c	0.987c	1.028c	1.026c

A decade ago the Atchison was classed as a "granger" because of its relatively large ratio of grain tonnage. This ratio has since declined more than 60 per cent. The loss in grain traffic has been compensated by a gain in manufactured products (package freight) which is usually classed as "high grade" freight. The effect of this change is not indicated in the average receipts per ton-mile, the rate 1.007c in

1901 was approximately the same in 1912, *i. e.*, 1.026c.

Traffic Density. Large tonnage is the fundamental element in profitable railroad operations. In accord with the economic law of "increasing returns," railroad companies having their lines well supplied with traffic enjoy relatively lower operating costs than lines with light tonnage. The exception, as already pointed out, is when the proper facilities are lacking for handling and moving the business. Traffic expansion in volume and in density, however, has been generally attended by corresponding improvements in the machinery of railroad operation. Increasing density has brought larger engines, more capacious cars and better constructed roadbed and track. In other words, improvements permit the traffic as it becomes of a more wholesale character to be dealt with in a more wholesale and therefore in a more economical manner. If this cannot be done, the advantages of heavier traffic may be entirely lost to the railroad.

The measurement of traffic volume, or *traffic density*, as it is technically known, when taken in relation to physical factors is thus of the highest importance in analyzing operating results. Traffic density is ordinarily computed by dividing the total ton-miles by the miles of road operated in a railroad system. Thus, if a railroad moved 1,000,000 tons of freight an average distance per ton of 100 miles the ton-mileage would amount to 100,000,000 ton-miles. If the total length of line operated were 200

miles, then the freight density would be 500,000 *ton-miles per mile of road.* Passenger traffic density is measured in the same way. It is the quotient of the *passenger-miles* divided by the total miles operated for passenger business. These items are at best crude averages for indicating the extent of the railroad business. As has been already pointed out, it is manifestly impossible, in view of the great variety of commodities transported and the complicated services rendered by railroad companies, to assemble in a single average the record of actual work performed. Moreover, the handling of tonnage in increasing bulk is not necessarily reflected in increased revenues unless the proportion of the various classes of commodities remains unchanged. Different rates are received for transportation of different commodities. *However, unless there has been a substantial change in the character of a railroad company's tonnage, the average ton-miles-per-mile-of-line-operated is undoubtedly the best index of railroad business.* Whether this progress is reflected in increased net earnings depends on the adequacy of the physical facilities, the operating efficiency, and the retention of rates and charges.

Average Length of Haul. Along with *traffic density*, the *average haul per ton* is an influencing item in railroad revenues and operating costs. It is obtained by dividing the total ton-miles by the total tonnage received for shipment. If railroad services were merely confined to moving commodities in carload lots and without any handling at terminals or with-

out other service than the mere carriage, the varying length of the *average haul* would not greatly influence operating costs or freight rates. That railroad rates between different points do not vary directly with the distance is due almost entirely to uniformity of terminal charges regardless of the haul. Hence, it follows that *the greater the average haul the smaller proportionately will be the operating costs per unit of freight.* It is with good reason, therefore, that the railroads seek to obtain business insuring a long haul even though the rates are lower than on short-haul tonnage.

For comparative purposes, and as a factor considered separately from other factors influencing railroad operating results, the *average haul* is of limited statistical value. Some commodities are of such weight and bulk in relation to market value that to convey them long distances entails an economic loss. Included among this class are the basic materials of industry, such as coal, iron ore, and timber. On the other hand, manufactured articles of small bulk and high price may be moved great distances without substantially increasing the cost to the ultimate consumer. Consequently, the railroads carrying a large proportion of this high grade tonnage are naturally expected to have a longer *average haul* than those whose tonnage consists chiefly of low-grade, bulky articles. This result, however, is not always borne out in the yearly fluctuation of the *average haul.* Changes in the relative proportions of local and through traffic and in the length

of mileage operated as well as in the character of the freight tonnage are factors influencing the *average haul per ton.*

A further limitation to the use of the *average haul* for comparative purposes is the differences in the length of railroad companies' lines. Certainly, it would be utterly foolish to compare the average haul of a trunk line, such as the Pennsylvania or the Union Pacific, with that of a terminal road like the Reading or the Lackawanna. The former carry large tonnages of through traffic, whereas the latter, because of the relatively small road mileage, are compelled to transfer their long haul tonnage to connecting lines. It cannot be too greatly emphasized that statistical comparison is of little value unless the attendant circumstances are taken into account.

In considering the advantages of long-haul traffic, the offsetting effects of terminal expenses connected with each class of tonnage should be kept in mind. These charges vary not only as to commodities, but also as to manner of shipment. Goods shipped as package freight entail relatively higher handling costs at terminals than when shipped in carload lots. Moreover, one consignment of freight may require many times as much handling, storage, care and insurance as another consignment of equal weight shipped the same distance; and a ton of merchandise shipped to twenty different places is not a similar "cost of service" proposition as a ton shipped in one consignment, though the railroad's

revenue in each case may be approximately the same.

Diversity of freight business; growth in density of freight and passenger traffic; and increase in the length of haul are important features of American railroad progress. They are factors in the natural course of transportation development. The extent to which the railroads have participated in these economic advantages is exceedingly difficult to determine. One of the questions now agitating American railroad managers is how to retain for the shareholders a part of the gains of progressive transportation development that competition, legislation and the demands for better service tend to eliminate. One means of solving this problem is efficient and economical operation. To properly gauge the attainments along these lines requires the use of satisfactory statistical units.

STATISTICS FOR MEASURING OPERATING ECONOMY AND EFFICIENCY

These widely used statistics have been adopted primarily to assist railroad managers in the intelligent operation of their lines. They, however, furnish information of the service given to the public as well as of managerial efficiency. Railroad rivalry and competition, and the necessity of maintaining railroad credit to provide for new capital requirements create a desire on the part of operating officials to make "a good showing." In this way the standard

units for measuring operating costs have been developed. These units when interpreted properly become an effective test of efficiency as well as a means of administrative control.

The principal standard units applied in the measurement of operating efficiency and economy are the so-called "mileage costs." These comprise deductions from the *ton-mile* and *passenger-mile*, the *locomotive-mile, the train-mile* and the *car-mile* averages. In handling these standard units, or in using them for purposes of comparison, extreme caution is essential. Possible changes and differences in physical facilities, in the character of the traffic and in managerial policy must be constantly kept in mind. Even within the same railroad system it is frequently decidedly unfair to measure operating results of one division against another on the sole basis of "mileage" averages. Such comparisons would take for granted similar physical, traffic, labor and climatic conditions as well as similarity in methods of supervision and in administrative skill.

It is not our purpose in this work to analyze in detail the numerous averages and combinations of standard traffic units contained in railroad and Government reports. Attention shall be given merely to those that are most commonly used and serve best in determining relative operating efficiency. Among the principal units adapted to this purpose are:

(*a*) the Train-mile,

(*b*) the Locomotive-mile,

(*c*) the Car-mile,

(*d*) the Average Train-load,

(*e*) the Average Car-load.

Each of these will be considered in turn.

Train-mile. The technical conception of a *train-mile* is the movement a distance of one mile of one or more locomotives attached to any number of cars. The lack of definiteness in this conception destroys in large part the usefulness generally ascribed to the *train-mile* unit in establishing a comparative basis for measuring efficiency and operating costs. A passenger train may mean everything from a creeping branch-line local consisting of an antiquated locomotive and a half-baggage, half-passenger coach to a luxuriously appointed express of a dozen or more steel cars moved at the rate of 60 miles an hour. Similarly, a freight train may connote anything from a box car behind an engine of ancient type to a train of a hundred gigantic steel cars hauled by two or more powerful compound locomotives. A general average obtained from units of such varying characteristics is essentially defective unless modified in accordance with the attendant circumstances in each case.

Having in view the lack of homogeneity in the *train-mile*, the term cannot correctly be applied unconditionally as a cost or efficiency index. To say, off hand, that one railroad is operated more economically than another because its freight train-mileage is smaller in relation to the total ton-miles, or because it has smaller operating expenses *per*

train-mile, is like saying that a brick layer accomplishes more work than a stone mason because in a day's work more bricks than granite blocks are placed in a wall. Obviously, the *train-mile* will serve as a unit of cost and of efficiency only when there is an approximate uniformity in the units from which the general average is made, *i. e.*, when all the factors, such as the class of commodities carried; the kind and capacity of cars; and the number, tractive power and speed of locomotives are proportioned alike throughout the aggregations from which the arithmetical averages in each case are produced. Moreover, railroads compared on the basis of *train-mile* averages should be similar in physical and in topographical characteristics and should have equal supply of rolling stock and motive power in relation to tonnage and traffic density. As possible comparisons under such circumstances are, to say the least, exceedingly rare, the use of the *train-mile* unit as a basic measurement of railroad operating efficiency and economy requires the utmost caution.

The *train-mile* unit, in spite of its limitations as a statistical average, serves an important function in the administrative control of railroad operations. In fact, *railroad transportation essentially consists in buying train-mileage and selling ton-miles and passenger-miles.* Therefore, as little train-mileage should be purchased as is economically possible in relation to the traffic units sold. A manufacturer or merchant may exceed his actual needs in the purchase of goods and materials, because the surplus can be

stored for future use. The railroad, however, that buys more train-mileage at a given time than is actually required by the traffic units is paying for something that cannot be stored and that is irretrievably lost. Accordingly, a reduction of train-mileage without corresponding decrease in the ton-mileage, all other factors remaining substantially unchanged, is evidence of more economical operation. On the Erie Railroad, for example, the *revenue ton-miles* were 1,990,807 or 41 per cent. more in 1911 than in 1899. The total *freight train-mileage*, however, *decreased* in the same period from 15,277,747 to 13,066,626, or 14 per cent. Similarly, on the Burlington the *freight train-miles* (including mixed train-miles) declined from 19,314,987 in 1901 to 17,554,338 in 1912, or a decrease of 9.1 per cent. In the meantime, however, the *ton-miles* increased from 3,871,337,916 to 7,675,979,757 or 98.3 per cent. In other words, substantially twice the freight business of 1901 was handled by the Burlington in 1912 with a decrease of about 10 per cent. in *freight train-miles*. Of course, these results have been produced by heavy additional capital investment, possibly to a greater extent than by enhanced operating efficiency. Both Erie's and Burlington's locomotives have become larger; grades have been eliminated and other improvements have been made in order to increase the size of trains and thus reduce the *train-miles*. To understand how much each factor has contributed to the results obtained requires study of the physical improvements as well as

an analysis of the average *train-load* and other standard units for measuring railroad service and costs.

The Locomotive-mile. As a statistical average, the same limitations are applied to the *locomotive-mile* as to the *train-mile.* The varieties of locomotives in kind and quality almost defy classification. Besides being grouped under passenger, freight and switching engines, locomotives may be single expansion Pacific type; consolidated with high tractive or with low tractive power; high-speed Atlantic type or low-speed articulated, etc. All these have different hauling power. There is no relative uniformity in their first cost, in their maintenance or in their operating expense. To be of practical value in indicating cost and performance, the *locomotive-mile* as any other statistical average must be based on a homogeneous aggregate. This would require engines to be of the same general type and class or of various classes equally proportioned. Even with this uniformity the influence of varying features of topography and roadbed, such as grades, curves and the like, must have proper consideration. There is, therefore, under existing conditions no uniform relation between the amount of work performed and the cost of the performance in the *locomotive-mile* unit. Considerable adjustment is obviously required before this standard can be accepted as a cost or as an efficiency index.

Inasmuch as locomotive operating costs are related to the time engines are employed as well as to the actual performance, the *locomotive-hour* has been

suggested as an index preferable to the *locomotive-mile.* The *tractive-power-hour, i. e.,* per-pound-tractive-power-per-locomotive-hour as a standard for measuring both cost and efficiency of performance has been recommended by a committee of the Association of Transportation and Car-Accounting Officers. The employment of this average will eliminate many of the objections applying to the *locomotive-mile,* since the basic units, *i. e., tractive-power pound* and *the hour,* are each homogeneous in respect to the aggregates.

The Average Car-mile. Car-mileage performance is an important element in the measurement of efficiency. As a statistical standard it is logically based upon the actual movement of the cars in service. Thus, the calculation of the *average mileage per freight car* would be the quotient of the actual mileage covered by cars in use divided by the number of these cars. In the statistical returns of railroad companies, the result is not always thus correctly obtained. In the first place, the number of car-units used in the computation of average *car-miles* may be those owned on the last day of the month or year. Secondly, the total car-mileage includes the mileage covered by *hired* cars as well as by those owned. Now it is very likely that the number of cars owned and in service on the last day of the fiscal year is not the same as the "average" for all days. Moreover, the number of rented cars on a company's lines may not be the same as the number of cars hired to other railroads.

The practical defects in compiling absolutely correct data are not the only difficulties hindering the measurement of freight car service. Disparities in the ratio of "empty" to loaded car mileage directly affect the average car movement. *Car-capacity* and *car-construction* are also essential particulars before an equitable basis can be obtained for comparing freight car performance as between different railroads, or on the same system at different periods of time.

Aside from these difficulties, there is a further artificial limitation arising from the varying demurrage regulations prevailing in the different territorial sections. In some states the legal period allowed for unloading a car without penalty for delay is forty-eight hours, and in others it is as high as seventy-two hours.[1] Obviously, the longer period allowed the greater the restriction on the free movement of cars in service. This would hinder a good showing in car performance.

After summing up all these conditions, it is quite conceivable that a lower *average car-mileage per freight car* on one line may represent greater operating efficiency and economy than a higher average on another line better favored by conditions promoting a free movement and a maximum use of cars.

A further circumstance limiting the performance of both passenger and freight cars is the irregularity

[1] Uniform demurrage rules are being gradually adopted throughout the United States, so that this difficulty in the equitable measurement of car performance is being eliminated.

in the volume of traffic offered to some railroads as compared with others. If the business of moving passengers and freight came uniformly each day, its profitableness to the railroads would be greatly enhanced. On a great many lines equipment must be held "idle" for many days in order to be in readiness to move the business when offered. Grain, cotton and fruit are harvested once a year and are forced on the roads for movement in from one to four months. The American Railroad Association's monthly statistics of car performance occasionally show disparities of 40 per cent. or more in the tonnage movement. This means that on some lines there is an "idle" period for a large part of the car equipment, and when these "idle" cars are used, they are frequently handled by inefficient, temporary employees.

Owing to the conditions under which railroad operating statistics are compiled, and the complications and expense incident to their proper preparation, it is extremely foolhardy for railroad managers or investors to rely on one item as an absolute index of efficiency in operation. Because of the great public inconvenience and loss from "car shortages," however, freight car performance statistics are carefully studied. The American Railway Association, for a number of years, has been collecting and publishing general data of this sort. The public is now furnished with periodical statements of the loaded car percentage to total car movement and with data showing available car supply. There are, in addition

statistics of actual car performance, viz.: the *average ton-miles per car per day.* Comparative statistical summaries are published from time to time by the American Railway Association so that both the railroads and shippers may know the relative progress of each company in improved car efficiency.

Average Train-load. As a basis in gauging comparative operating efficiency, the *average train-load* (*i. e.*, the total *ton-miles* divided by the *total train-miles*) presents the same inherent defects as are encountered in *ton-mile* costs. A line with heavy grades must necessarily adjust the loading to the hauling capacity over these grades or undergo the use of "pushers" and "double headers." This practice by some companies of operating many trains with two or more locomotives may destroy the efficacy of the *average train-load* as an efficiency index since it alters the relation of operating costs to the train's tonnage.

The character of commodities carried is also of importance as an influence in "maximum" loading. A train-load of silk hauled in three ordinary box cars will bring in a gross revenue probably greater than a consignment of lumber comprising a train of forty cars and having a net weight of 2,000,000 pounds. The relative proportion of *car-load* and *less than car-load* shipments on each system is also a factor in determining the *average train-load.* Car-load consignments are computed as equal in weight to the marked capacity of the car whether under or over this amount, whereas, package freight is actually weighed before shipment. It frequently happens

that shippers, in order to have the advantage of the lower car-load rate will hire a car though the consignment is much less than the capacity of the car. This practice, if pronounced, on a railroad company's lines, produces an erroneous statement of the *average train-load*. Moreover, in the *train-load* computations no consideration is given to differences in the tare or "dead" weight of cars. The weight of cars is as much a limitation on locomotive tonnage-rating as grades, speed and air temperature.

Average Car-load. As a statistical unit, the *average car-load, i. e.*, average tons carried per loaded freight car-mile, is in the same category as the average *train-load*. The disparities in the quality and carrying capacity of cars as well as in the different classes of goods carried are here also potent factors affecting the validity of statistical comparisons. However, the question of utilizing car capacity to the best advantage is a matter of general importance to the public as well as to railroad officials and stockholders. The Committee on Car Efficiency of The American Railway Association, which has been investigating the problem, has adopted as the best available combination unit of car efficiency, *the ton-miles hauled per freight car in service per day.* Their statistics indicate that this item is steadily increasing. The largest average number of *tons hauled one mile per car per day* in 1907 was 348; the largest in 1909, 413, and in October, 1912, 434 *ton-miles per car per day*. An interesting problem is whether this general increase has been secured by better car

loading, by reduction of empty car mileage or by larger carrying capacity.

In view of the constant increase in size of cars, there is considerable controversy as to whether the average loading in recent years has kept pace with the increased average carrying capacity. In 1910, as compared with 1902, freight-ton mileage increased 59 per cent., total car-capacity 69 per cent., and total car-mileage 41 per cent., while the increase in the average tons moved *per loaded freight-car-mile* was from 16.9 tons in 1902 to 19.8 tons in 1910, an increase of less than 18 per cent. This either reflects a lowering of car efficiency or an increase in the average car-capacity beyond the limits warranted by traffic conditions. Actual tests on several roads (more particularly the Erie and the Lackawanna) seem to demonstrate that with the development of package freight shipments and the demand for fast freight service, cars are frequently moved with loads less than one-half of their capacity.

Train Frequency and Speed. The highest operating economy manifestly implies that each locomotive and each car on every line shall, during a given time, move the maximum number of tons with proper expedition and at a minimum expense. To accomplish this requires, (aside from perfect managerial skill), an abundance of traffic and a good roadbed, well maintained and adequately equipped with motive power and rolling stock. If the volume of traffic at each point is not commensurate with equipment capacity, heavy car-loads and train-

loads may be directly opposed to *speed* and *train frequency.* The character of transportation service, therefore, demands consideration in estimates of operating efficiency and economy. Though good railroad management decrees the handling of traffic at the lowest operating costs, business requires that it be handled speedily. To satisfy the public demand the best railroads maintain time schedules in freight as well as in passenger service. In some cases actual tests have demonstrated that "time" freight trains are handled more economically in relation to revenue than the "tonnage" trains.

The leading railroad systems in the United States operate on the principle that it is not economical to have the locomotives haul the maximum load at the minimum speed. Delays caused by "loading" equal to the locomotive capacity frequently result in greater loss than gain. The same number of cars and locomotives when loaded lightly so as to make speed may handle considerably more freight in a given period of time than when "held up" at stations and division points awaiting a full load. Besides, loading at or near to the maximum hauling capacity of the locomotive enhances the liability to locomotive break-downs. It is a well known fact that changes in temperature and other climatic conditions alter train-resistance.[1] The resistance offered by railroad trains is greater in cold weather than it is under

[1] See *University of Illinois Bulletin*, No. 59. "The effects of cold weather upon train resistance and tonnage rating," by Ed. C. Schmidt and F. W. Marquis.

ordinary temperatures. Recognition of this fact has led to the reduction of "tonnage ratings," (*i. e.*, the maximum loading) of locomotives during cold weather. This practice is almost universal among railroads in the northern part of the United States and in Canada. Any study of economical train loading, therefore, should recognize the factor of air temperature as well as of speed and of train frequency.

Conclusion. It is such factors as the foregoing that make the proper interpretation of statistical units measuring operating efficiency a most complicated and difficult task. Satisfactory results cannot be obtained merely by study of the bare statistics. The operating conditions must be thoroughly known before safe conclusions can be drawn. It is apparent, therefore, that the testing of railroad economy and efficiency through the use of selected statistical units requires the greatest caution. There are so many diverse factors and attendant circumstances which destroy or impair the efficacy of the different units. To illustrate: An attempt is made to measure progress in locomotive-efficiency by a year to year comparison of *tons hauled per locomotive-mile*. This, however, is found unsatisfactory because no account is taken of the changes in the size and tractive power of the locomotives. A comparison is then made on the basis of *ton-miles moved per pound of locomotive tractive-power*. But this gives no consideration to changes in the character or in the density of freight

traffic. A further analysis based on the combination of units which gives consideration to the time each locomotive was in use (*locomotive-hours*) and to fluctuations in volume of traffic (*ton-miles per mile of road*) must be made. There may be further objections, however. The relative supply of locomotives and rolling stock may have varied at different periods. These are contributory elements in measuring efficiency. Moreover, the progressive improvement in alignment and in superstructure of roadbed places each year on an unequal comparative basis. Were railroad operations subject to purely static instead of highly dynamic conditions the measure of efficiency and economy through the use of unrefined traffic statistics would be an easy matter.

When it comes to a comparison of the operating efficiency of different railroad systems on the basis of statistical averages, the liability to erroneous conclusions demands full consideration of all factors influencing operations. The St. Louis & San Francisco Railroad and the Chicago, Rock Island & Pacific, though not altogether similar in geographical location of lines and in traffic conditions, afford an interesting statistical comparison. The 'Frisco serves Kansas, Missouri, Arkansas, Tennessee and Oklahoma, and taps Texas. The Rock Island has its lines for the most part west and north of Chicago, covering Minnesota, Iowa, Missouri, Kansas, Colorado and Oklahoma. It also has a line reaching the Mexican border in New Mexico and another which runs from Oklahoma into Arkansas and Louisiana.

Thus, the two companies cover partly the same geographical regions, though the 'Frisco has no through line corresponding to that of the Rock Island running between Chicago and Denver and north thereof. The average mileage operated by the 'Frisco exclusive of the Chicago & Eastern Illinois, during the fiscal year 1911, was 5,188 miles as against the Chicago, Rock Island & Pacific's 8,026 miles.

As far as division of revenue is concerned, the Rock Island and the 'Frisco are much alike. Sixty-seven per cent. of gross revenue came from freight on the 'Frisco, compared with 63.3 per cent. from freight on the Rock Island. Freight density is also much the same on both roads. In 1911 the *average ton-miles per mile of road* on the 'Frisco amounted to 515,754, and on the Rock Island to 587,890. The *average revenue per ton-mile* on the 'Frisco, in 1911 was 1.05 cents, an increase of .7 of a mill over 1910. The *revenue per ton per mile* on the Rock Island is somewhat lower, in 1911 averaging 9.2 mills.

As might be expected, the 'Frisco, not having any long through route comparable to the Rock Island's main line from Chicago to Denver gets a much shorter *average haul* of freight. This *average haul* in 1911 was 156.21 miles on the 'Frisco and 246.80 miles on the Rock Island. However, a greater proportion of the 'Frisco's traffic consists of "low grade," bulky materials than is the case with the Rock Island and to this may be due in part its shorter *average haul.* In 1911, *Products of Mines and of Forests* comprised

57.96 per cent. of 'Frisco's tonnage as against 41.05 per cent. of the Rock Island's.[1]

TRAIN-MILE AVERAGES

Year ended June 30th,	*Rock Island*		*St. Louis & San Francisco*	
	1911	*1910*	*1911*	*1910*
Freight Density	587.890	567.792	515.754	557.886
Average Revenue Train-load	269.66	257.43	220.93	222.91
Revenue per Freight Train-mile	$2.479	$2.380	$2.318	$2.178
Freight train-miles per mile of road	2.096	2.110	2.245	2.429

Since the ratio of freight revenue to total operating revenue is much the same on both roads, and since traffic density is also not widely different, the foregoing statistical comparison of *train-mile* and *locomotive-mile* averages is interesting and requires careful study.

[1] The following table shows the percentage of the tonnage of each class of commodity to the total tonnage carried by each company.

	Rock Island		*St. Louis & San Francisco*	
	Per cent. of total freight			
	1911	*1910*	*1911*	*1910*
	%	%	%	%
Products of Agriculture	25.88	22.13	16.31	14.80
Products of Animals	7.68	7.08	4.02	3.47
Products of Mines	29.46	31.93	38.57	40.41
Products of Forests	11.59	12.34	19.39	20.72
Manufactures	18.41	19.55	15.75	15.44
Merchandise *	6.57	6.46	5.35	4.94
Miscellaneous	.41	.50	.61	.22
Total	100.00	100.00	100.00	100.00

* Represents all less than car-load shipments.

The figures call for interpretation. The Rock Island's density of traffic in 1911 was 587.890 *ton-miles* or approximately 14 per cent. greater than the 'Frisco's. Rock Island's *freight train-miles per mile of road*, however, was 6 per cent. less. This economic advantage of the Rock Island is accounted for by the *heavier average train-load* (*i. e.* the number of tons per train-mile) which in 1911 was 48.73 tons or 22 per cent. greater than 'Frisco's *average train-load.* The Rock Island's heavier *train-load* is obtained with a smaller proportion of bulky freight, as shown on the preceding page. Smaller proportion of low grade tonnage naturally has resulted in slightly larger revenue *per freight train-mile*, since Rock Island in 1911 received an average of $2,479 against $2,318 received by the 'Frisco as freight revenue for each *freight train-mile.* It appears, therefore, that the Rock Island has an economic advantage over its sister road in that it is enabled to handle its tonnage in a more wholesale manner, receiving at the same time a larger revenue *per train-mile.*

A comparison of locomotive performance, however, such as is shown on the opposite page, is necessary to substantiate this conclusion.

It should be observed that although the Rock Island handles more tonnage *per locomotive-mile* than the 'Frisco the *average locomotive tractive power* of the former is the greater. This excess in average locomotive capacity, however, is relatively slight. In 1911, the *ton-miles per freight locomotive-mile* on the Rock Island was 319.7 against 267.5 on the

LOCOMOTIVE-MILE AVERAGES

Year ended June 30th	Rock Island		St. Louis & San Francisco	
	1911	1910	1911	1910
Total ton-miles per freight locomotive mile [1]	319.7	299.8	267.5	269.4
Average tractive power per locomotive (lbs.)	27,622	26,690	26,864	25,927
Average locomotive-miles per locomotive	27,770	30,500	28,190	29,520
Expenses per locomotive-mile	38.89c	35.88c	35.49c	35.69c

'Frisco, an advantage of approximately 25 per cent. The Rock Island's *average tractive power per locomotive,* however, exceeded that of the 'Frisco by less than 3 per cent. At this point in our analysis of locomotive performance we must logically conclude that the results on the Rock Island indicate greater operating efficiency. But the miles run by each locomotive (*average locomotive-miles per locomotive*) is an important factor. In 1911 the Rock Island in this respect fell slightly behind the 'Frisco, though in the previous year it was ahead, having 30,500 against 'Frisco's 29,520 *locomotive-miles per locomotive.* In computing this item however, the *average locomotives in service* is assumed to be the number at the end of the year less one-half of the increase (or plus half the decrease) over the number at the year's beginning. This computation may introduce an element of error. New locomotives may be put

[1] Includes company "non-revenue" freight.

into service and old ones withdrawn either at the beginning or at the end of the year and not *gradually* throughout the period as is assumed in the statistical comparison.

An important factor of locomotive efficiency is the operating cost in relation to the work done. In the table it is shown that the *cost per locomotive-mile* on both roads in the year 1910 was, approximately, the same notwithstanding Rock Island's larger ton-mileage *per locomotive-mile.* In 1911, however, the *operating cost per locomotive-mile* on the Rock Island was 38.89c. compared with 35.69c. on the 'Frisco. Thus, the Rock Island's advantage in operating efficiency as exhibited in the *train-mile* and *locomotive-mile averages* is impaired to some extent by the rise in the locomotive operating cost per mile-run in 1911. This may indicate that efficiency is acquired through sacrifice of economy.

CHAPTER VIII

INTERSTATE COMMERCE COMMISSION'S SYSTEM OF RAILROAD ACCOUNTS

Classification of Railroad Financial Data. The portion of a railroad report containing the financial data can be separated into three divisions represented by (1) the *Income Account*, (2) the *Profit & Loss (or Surplus) Account*, and (3) the *General Balance Sheet*. These three parts are co-related and interdependent. Changes in one are generally reflected in either or both of the other two. The *Income Account* and the *Profit & Loss Account* have to do, respectively, with *operation* and with *proprietorship*. By proprietorship is meant the net gain (or loss) in the corporation other than that represented by the nominal investment.

The data of *operation* (*i. e.*, the *Income Account*) show how the periodical profits or losses were arrived at. The *Profit & Loss Account* shows the distribution of these net profits and the part thereof that remains in the business as a surplus. The *General Balance Sheet*, on the other hand, is a statement of financial condition. It shows on a given date, in summarized form, the resources or assets and the offsetting liabilities or claims. Among the liabilities are included the *Profit & Loss*, and other

items representing *net proprietorship.* The inclusion of the net proprietorship among the liabilities forms the connecting link between the *Income Account* and the *General Balance Sheet.* Thus, the *Income Account* exhibits the financial operations producing the clear gain or loss of the company's operations during a definite period. This gain or loss may be directly taken up by the proprietors (*i. e.*, the stockholders), or it may be transferred in whole or in part to the *Profit & Loss Account.* In the latter event, the net proprietorship of the corporation is increased if profits are added, and decreased if losses are deducted. A corresponding change, therefore, results in the *General Balance Sheet.* The *Profit & Loss,* or *Surplus,* as it is commonly called, is thus the account for recording *the net financial change wrought by past operations on the present condition of the corporation.* It completes the summary of the *General Balance Sheet* as an exhibit of financial condition. In the words of Prof. Wm. M. Cole:[1]

> Only the balance sheet represents the present condition, whereas, the income sheet represents the transactions which produced that condition, but ceased to have independence as soon as they were completed.

It is for this reason that all financial transactions which are entered only in the *Income Account* are said to be "charged to income" as distinguished from transactions which are entered in the *General Balance Sheet* (either directly or through the *Profit & Loss Account*), which are said to be "charged to capital."

[1] "Accounts, Their Construction and Interpretation," by Wm. Morse Cole, p. 71.

An expenditure "charged to income" does not become a part of the assets or of *proprietorship.* Hence, none of the items of the *General Balance Sheet* are in any way affected. An expenditure charged to *Profit & Loss,* however, affects *net proprietorship,* and reduces this item in the *General Balance Sheet.* The transaction is, therefore, reflected in the exhibit of financial condition. Similarly, an expenditure which is made directly for the purpose of increasing assets or reducing liabilities, and which is not recorded among the data of operation, is a "charge against capital." The transaction may be recorded in one or more items among the assets and in one or more items among the liabilities.

With this brief résumé of fundamental accounting principles, we shall proceed to a study of the prevailing system of railroad accounts as affecting the interests of investors and of the public.

In tracing the affairs and transactions of American railroad companies, "outsiders" have a less difficult task than in an analysis of other business enterprises. In railroad operations there is a standardization and uniformity of accounting methods that insures an intelligible presentation of financial returns. The 20th section of the Interstate Commerce Act, approved June 29, 1906, authorized the Interstate Commerce Commission to prescribe and supervise a uniform system of accounting for each class of interstate common carriers. Beginning with the year ended June 30, 1908, a uniform accounting

system was installed for interstate railroad companies. The Interstate Commerce Commission's agents have legal authority to inspect railroad accounts and records.

Previous to the enforcement of a uniform accounting system the leading railroad systems had followed similar methods of bookkeeping. Uniformity was not compulsory, however, and departure from standard practice was permitted. Each railroad was at liberty to follow its own system without regard to the rights and interests of the public or of any class of security holders. Occasional receiverships when large profits and equities were reported were due to lax accounting methods.

The Underlying Motives of the Interstate Commerce Commission's Accounting System. In drafting a system of railroad accounts, two motives appear to have actuated the Interstate Commerce Commission. The first was the desire to know actual operating costs so as to have a basis of equitable rate making. Cost data, to be authentic and incontrovertible, require the keeping of accounts in a prescribed and uniform manner, and their publication in accurate and intelligent form. The second motive back of the uniform accounting system is the desire for reliable statistical information correctly portraying the financial status and fiscal operations of the great transportation agencies. This probably more than any other consideration guided the Commission in its constructive work in providing a prescribed system of accounts.

The statistical purpose underlying the control of railroad accounts is undoubtedly closely related to and interwoven with the need of an authentic basis for correct statement of operating expenses. Without uniformity of accounts for all carriers of the same class, and without means of detecting false and misleading returns, it is very unlikely that fair and correct statements of the financial condition and operating results of the carriers as a whole can be obtained. Moreover, the publication of misleading or inadequate statistics by a governmental agency possessing the authority and prestige of the Interstate Commerce Commission accomplishes no useful purpose and may result in public injury. On the other hand, the systematization of railroad accounts so as to meet the demand for clear and intelligent statistics should entail neither sacrifice nor violation of the principles upon which modern business accounting is based. When there are no conflicts of this character the accounts of transportation agencies can be readily and safely adjusted to serve statistical purposes. In this respect their value as public records is greatly enhanced.

Principal Accounting Regulations. The controlling motives of the Interstate Commerce Commission produced a system of railroad accounts designed more to meet the broader and comprehensive requirements of public regulation than to specifically serve the purposes and desires of railroad managers and security holders. The aim to have the operating costs serve as a rate making basis led to rigid regu-

lations in certain accounting details which previously had been dealt with independently in accordance with the individual financial policy of each railroad. Important among these regulations are:

(1) The absolute separation of rail transportation operations from ancillary operations. SUBORDINATE

(2) The exclusion of taxes from among the direct costs of operation.

(3) The establishment of joint facilities accounts on a uniform basis.

(4) The inclusion of depreciation charges as a direct operating expense.

(5) Rigid classification of improvement and betterment expenditures.

(6) Uniform practice in crediting premiums received and charging discounts paid in the sale of capital securities.

(7) Strict regulations regarding losses from the abandonment of physical property.

The enforcement of these regulations prescribed with a view to determining actual operating costs has met with some serious criticism and complaint on the part of railroad managers. Regarding the first three items there was little objection, although the resulting bookkeeping adjustments entailed many difficulties. It is well known that railroads are engaged directly in a number of operations other than transportation by rail. For the most part, these operations are intimately connected with or are ancillary to the business of transporting passengers and freight. The revenue as well as the ex-

pense incident to them nevertheless is sufficiently distinct from the revenues and expenses which accrue on account of rail transportation to permit separate accounting. This distinction has led to the recognition of a class of accounts designated as "*Outside Operations*." They cover the operations of harbor terminals, ferries, elevators, electric light and power plants, stock yards and the like. The motive for requiring a separate set of accounts for this class of activities is expressed in the following official definition for "*Outside Operations:*"

> Outside operations are facilities operated or services rendered by a railroad other than those incidental to transportation by rail, the revenues and expenses of which, if included in the carrier's accounts dealing with transportation by rail, would impair the significance of statistics prepared from such accounts.

Joint Facilities Accounts. A similar motive underlies the requirement of *Joint Facilities Accounts* on a uniform basis. It is the common practice of railroads to use jointly with other companies certain physical facilities such as terminals, tracks, bridges and the like. The *Joint Facilities Accounts* are provided in order to ascertain the operating expenses of each company without reference to any service rendered by it to another carrier or to any service rendered by another carrier to it. In other words, the participation of any railroad in the operations of another may by means of the *Joint Facilities Accounts* be so shown that a combined statement of the operating expenses of all carriers would represent neither more nor less than their true expenses of operation.

Thus, the *Joint Facilities Accounts* debar a railroad from including in its transportation earnings certain revenues which are not derived directly from the public for transportation or for kindred service. They also prevent the inclusion among operating expenses of payments for the use of capital. Thus, rental paid for a track which is maintained and operated at the expense of the lessee represents merely a payment for the use of the property. This rent is not affected in any manner by the various acts of operation. It is not, therefore, an operating expense. According to accounting principles, rentals are expenses similar to interest and taxes when the full amount of the payments represent merely the reward for the use of capital. Frequently, however, rental payments cover costs of upkeep, depreciation, wages of employees, etc. All this requires a distribution of the revenues and expenses arising from joint facilities in a uniform manner over the various accounts of each company so as to properly show how much represents operating activities and how much represents receipts and payment for the use of capital.

Enforced Maintenance of Depreciation Accounts. The Commission's rulings regarding the maintenance of depreciation accounts were promulgated with special reference to railroad cost accounting. Their enforcement brought forth the most determined opposition. Among those active in protesting against the keeping of depreciation accounts were the largest, best-equipped and most conservatively

managed railroad companies. Some of these claimed that the renewals and repairs to their equipment were made at a rate which tended to maintain the property at a uniform standard of efficiency at all times. Accordingly, there was no necessity for depreciation accounts on their books. A number of other railroads, including the Pennsylvania, the New York Central and the Norfolk & Western, provided for depreciation of equipment largely through sinking fund charges on their equipment obligations. Probably in no two important railroad systems were the methods of treating depreciation charges identical. Depreciation accounts, similar to reserve and sinking fund accounts, are not necessarily entries of actual and tangible transactions, but are mere records of provisions for current and prospective losses. The money value of the provisions must, therefore, be estimated. The estimates, however, are largely based on experience, and the railroad managers contend that they are capable of attending properly to such matters.[1]

Classification of Additions and Betterments. In its classification of additions and betterments, the Commission directed a blow against the creation of hidden assets by the railroads and the concealment of profits through inflation of current operating expenses. A number of American railroads had gone beyond the recognized principle of charging operating

[1] The railroads at the present writing are required to keep depreciation accounts only with respect to their rolling equipment. With respect to other property the matter is optional with the companies.

expenses with only the cost of such improvements and betterments as do not produce revenue. By charging productive improvements to operation, they have actually increased their capital assets through current income without having a permanent record thereof on their books. The continuation of this practice under the Interstate Commerce Commission's control would seriously impair the value of railroad accounts as a gauge of actual operating costs. The Commission, therefore, in distinguishing between expenditures "chargeable to capital" and expenditures "chargeable to income," applied a rigid rule for all the railroads regardless of their varying traffic conditions and financial policies.

In rail replacements, for example, the Commission has ordered that when heavier rails than those replaced are put down, the difference in cost arising from additional weight is a capital expense and must not be charged against operating revenues. On the Philadelphia & Reading Railroad, this ruling resulted during the year 1910 in an addition of $158,976 to property account, which in previous years would have been included in maintenance charges.

Thus, the prescribed rule in replacements and renewals permits operating expense to be charged only with the cost of the original structure replaced. Many experienced railroad officers, however, claim that in all such cases operating expenses should be charged with *the full amount necessary to preserve*

earning efficiency. They point out that by reason of the larger, heavier, more frequent and more luxurious service called for by modern traffic, together with the keen competition among the railroads and the demand of the shippers and traveling public for better facilities, it is vitally necessary to charge to operating expenses all extra charges required to preserve the railroad in the same general earning status as it was before. In other words, since railroad facilities are constantly improved and increased to preserve earning capacity the necessary expenses for doing this must be met in part at least from revenue.

Railroad improvements may be roughly divided into two classes—those which increase the earning capacity in proportion to their cost, and those which do not. To the latter class belong the handsome and expensive passenger terminals which the cities are demanding. A new passenger station at Kansas City costs $2,000,000. A station fully serving the needs of the public could be built for $200,000. Thus, nine-tenths of the expenditure is to appease the æsthetic ambition of the local citizens. Only one-tenth is to increase earning capacity. It is frequently the same with expenditure for track elevation in cities. This promotes public safety and convenience. It also tends to reduce operating expenses. The cost, however, in most cases greatly exceeds the purely economic benefits gained by the railroad. Financiers contend that these improvements should be paid for at least partly by charges to operating

expenses as well as from the surplus earnings or from the sale of securities.[1]

Commissions and Discounts Paid or Premiums Received from Sale of Securities. Railroad financiers and managers have also criticised official regulations regarding commissions and discounts paid or premiums received in connection with the sale of securities. Commissions and discounts, when paid in connection with stock issues are required to be carried on the books as a "permanently deferred asset" until the stock sold is returned or converted, or until the discount is extinguished by premiums realized on subsequent sales of the same class of stock. "If the stock is retired or converted, the discount is then a charge against *Profit & Loss* or against the premium realized, if any, at the date of such retirement or conversion." In other words, such discount

[1] The question of railroad betterments and depreciation is also under discussion in Great Britain. The Committee of the Board of Trade appointed to inquire into the matter unanimously agreed that the management of each company should be permitted to decide what expenses were mere maintenance and what were betterments. Mr. W. M. Acworth, who was a member of the Board of Trade Committee, remarks:

"We come then to the conclusion that all interests, the interest alike of the public and of the shareholders, are best served by charging freely, not mere repairs and renewals (*i. e.*, depreciation), against the annual income, but also substantial sums for additions and improvements, and, further, for what perhaps might be described as contingencies. In other words, the real test of what part of the gross income is net income is, not whether the physical corpus of the property has been adequately kept up, but whether the earning power of the undertaking as a whole is being maintained." See "Railroad Accounting in America vs. England," *North American Review*, March, 1910.

may not be charged against income, though this policy is in line with correct accounting principles.

In the case of the sale of bonds or other form of funded obligations, the Commission requires that "the discount, unless extinguished by premiums existing on previous bond sales, should be charged to income in such equal annual installments during the life of the bonds as will extinguish the discount." The carrier may, however, at its option, charge to *Profit & Loss* all of the discount or any part of it remaining at any time unextinguished, *but the charge to income in any one year must not exceed the amount of the annual installment applicable to that year.* A similar regulation exists regarding the periodical crediting of premiums received in bond sales. The ostensible purpose of this ruling is to have each year bear proportionately the regularly recurring costs for the use of capital. Discounts and premiums on bonds are held to be, respectively, an addition to or a deduction from the rate of interest paid for loans. This theory underlies the separation of discounts and commissions when paid in connection with capital stock from the same items in connection with bond issues. Funded indebtedness is nominally redeemable after a fixed period during which the discount is amortized, whereas, capital stock is a perpetual obligation. Under the prevailing system of railroad capitalization, however, funded indebtedness is essentially as permanent as capital stock. None of the great railroads make full provision in advance for bond liquidation. Maturing bonds are

usually substituted by new issues.[1] The discount or premium at which railroad securities are sold frequently can be arbitrarily determined by the railroad management. It is largely dependent on the rate of interest they attach to such obligations, as well as on prevailing money market conditions and the credit status of the railroad company. Moreover, it is frequently discretionary with railroad financiers whether stock or bonds shall be sold to obtain new capital.

Losses on Account of Abandonment of Property. The method of accounting for the losses occasioned by abandonment of railroad property is one of the most serious of the technical problems in connection with the Interstate Commerce Commission's uniform system of accounts. According to a report of the Commission:

> On the part of the public, the argument is strong in support of the proposition that the Balance Sheet statement of "Cost of Property" should cover only that property actually used in rendering the service of transportation, and that abandoned property should therefore be taken out of the accounts; but the argument of the stockholder also has merit, which is that inasmuch as the property abandoned was abandoned to make way for providing the public with better facilities, and further, inasmuch as the first investment was necessary in order that the second investment might be made, it is scarcely just to require the stockholder to sustain the entire loss. A sense of equity and an appreciation of business conditions, rather than legal or accounting technicalities, would seem to be the element out of which such a policy should be constructed.[2]

The definite expression of the Commission's policy is contained in the following paragraph of the *Clas-*

[1] This is discussed in greater detail in Chapter XII.

[2] "Statistics of Railways," 1907, p. 20.

sification of Additions & Betterments, (1st revised issue), p. 15:

Property Retired and not Replaced. When property (other than equipment), an addition to or a betterment of which would be chargeable to the accounts of this classification, is abandoned or withdrawn from service and not replaced, the cost (estimated, if not known) should be credited to the account provided for such property; proper account should be taken of any salvage; the reserve accounts for abandoned and accrued depreciation should be debited with the amounts, if any, previously credited thereto with respect to the property abandoned or withdrawn, and *the difference between the salvage plus the reserves and the cost should be charged to Profit and Loss to which should also be charged any incidental expenses connected with the retirement.*

The Bulletin further provides:

If any unit of property the cost of which is less than $200 is abandoned and not replaced, the option may be exercised (unless the accounts covering such property are specifically excepted from this option) of making no credit entry with respect to such abandonment.

The foregoing provisions are restricted to property retired or abandoned *directly* in the process of improvement. Abandonment incidental to improvements or from other causes is held to be a loss chargeable entirely to current earnings. An exception is made when the aggregate amount of such loss in any one year should "unduly burden the accounts." In the latter event, after consent of the Commission, a portion of the loss may be "carried forward as a periodical charge against the earnings of subsequent years." The annual amount is to be determined in advance by agreement with the Interstate Commerce Commission.

The practical difficulties arising from the "abandoned property" rulings are well illustrated in a

legal dispute of the Kansas City Southern Railroad with the Interstate Commerce Commission. In 1909, the Kansas City Southern issued $10,000,000 bonds; out of the proceeds of which $1,250,000 was set aside for the reduction of grades. It was found cheaper at some points to build sections over new routes and to abandon the old sections rather than to raise or lower the old tracks at those points. The latter method would have cost $1,230,319, but by putting in new sections at six points the expense was reduced to $629,400. The sections abandoned were discarded, "not because they were out of repair or worn out or obsolete, but merely *as an incident* to the most economical method of effecting the improvement."

The regulations of the Commission required that from the cost of the improvements should be deducted the estimated value of the property abandoned—namely, $491,121—and that this amount (less salvage) should be entered as operating expense. "The injustice and absurdity of these regulations," says the brief in this case, "are clear from the fact that had the improvements been made on the original roadway, the regulations of the Commission, without any of this chaotic confusion, would have permitted and required that the entire expenditure be added to the property accounts, and no sum whatever would have been charged to operating expenses."

Further accounting rulings of the Commission have been criticised as being opposed to railroad

interests. It has been claimed that the accounting orders of the Commission go beyond the formulation of a system of accounts; that they encroach upon the legitimate right of railroad executives to manage the property placed in their care; and that the administration of these accounting orders implies an authority not conferred by law. There is undoubtedly some truth in these contentions. The public benefits of enforced publicity and accounting uniformity are only partially compensating factors.

The complexity of railroad organization and activities and the narrow margin of operating profit render extremely difficult a completely accurate statement of financial results. Every financial statement of a going business, no matter how accurately and scientifically drawn up is, at best, a mere approximation to truth. Considerable latitude of variation from exact facts may occur without willful intent to deceive. The earning of railroad profits represents a continuous operation. Actual results can be definitely stated only when the business is wound up and all assets realized in the form of cash. Moreover, the varying character of the railroad companies leads to many difficulties in determining their net incomes on uniform bases. Accounting methods in large systems are frequently impractical when applied to small roads. Capitalized items of expense in one case may be properly considered as charges against income in the other, and large capitalization of a well-equipped system may effect a showing of operating profits which would be en-

tirely wiped out under a smaller scale of capital investment.[1]

In calling attention here to the difficulties of laying down strictly defined rules of accounting practice, there is no purpose to disparage uniformity or publicity of methods. Any system which tends towards making published accounts of railroads more truly an exhibit of actual operating results is desirable as long as the information is supplied in simplified form, intelligible to the layman. Every one conversant with American railroad accounts knows that these have improved continuously in accuracy, in lucidity and in comprehensiveness. Much progress has been due to the activities of the Association of American Railway Accounting Officers. This organization has long maintained cordial relations with the officials of The Interstate Commerce Commission, and has co-operated in the formulation of a prescribed system of railroad accounts.

[1] The Interstate Commerce Commission prescribed a form of report for small roads with mileage 250 miles or less and having annual operating revenues of not more than $1,000,000. This form differs from that of large roads only in the reduction of a number of items required in accounts.

CHAPTER IX

THE INCOME ACCOUNT—OPERATING ACCOUNTS

The Form of the Income Account. "The Income Account" in the language of the Interstate Commerce Commission, "brings together those accounts which show the total amount of money that a company receives or becomes entitled to receive from its transportation and other operations during a given fiscal period; the return accrued during the period upon investments; the disbursements and obligations incurred that affect the amounts so received or accrued, and the disposition or allocation of the net income accrued." All this is exhibited in the official arrangement of the *Income Account* which is here given in condensed form:

Operating Income:
  Rail Operations:
    Operating Revenues,
    Operating Expenses,
    Net Operating Revenue,

Outside Operations:
  Revenues,
  Expenses,
    Net Revenue (or Deficit),
  Total Net Revenue,

(Deduct) Taxes Accrued:
    Operating Income,

Other Income:
- Rents Accrued from Lease of Road,
- Other Rents—Credits:
  - (a) Hire of Equipment—Balance
  - (b) Joint Facilities
  - (c) Miscellaneous Rents
- Separately Operated Properties—Profit
- Dividends Declared on Stocks Owned or Controlled.
- Interest Accrued on Funded Debt Owned or Controlled.
- Interest on Other Securities, Loans, and Accounts.

Gross Corporate Income,

Deductions from Gross Corporate Income:
- Rents Accrued from Lease of Other Roads.
- Other Rents—Debits:
  - (a) Hire of Equipment—Balance
  - (b) Joint Facilities
  - (c) Miscellaneous Rents.
- Separately Operated Properties—Loss

Interest Accrued on Funded Debt.
- Other Interest,
- Sinking Funds Chargeable to Income,
- Other Deductions.

Total deductions from Gross Corporate Income:
- Net Corporate Income (or Deficit),

Disposition of Net Corporate Income:
- Dividends Declared:
  - (a) On Preferred Stock
  - (b) On Common Stock
  - (c) On Other Securities.
- Additions and Betterments Charged to Income,
- Appropriations to Reserves,
- Miscellaneous:

Balance for Year Carried Forward to Profit & Loss.

This prescribed form, now generally followed in railroad reports, is in accord with correct accounting principles. The statement contains four principal

accounts (technically known as "general" accounts) under which the other items (secondary accounts) are grouped. The general accounts are, in their order: (1) *Railway Operating Income,*[1] (2) *Other Income,* (3) *Deductions from Gross Corporate Income,* and (4) *Disposition of Net Corporate Income.* Under the first are included in separate accounts the revenues and expenses of "rail" and of "outside" operations. The other general accounts are concerned with the general business of the company.

The separation in the accounts of the transportation business from the ancillary operations facilitates a comparison of the operating results of the various railroad systems. The separation of "Taxes" and "Rents" from the operating expenses establishes a uniformity, the absence of which in previous years was a source of difficulty in measuring operating costs. Similarly, the prescribed classifications under the second general account, *Other Income,* in which are included "*Rentals Received*" and "*Income from Securities,*" has greatly assisted in the correct analysis of railroad investment activities.

The third general account, "*Deductions from Gross Corporate Income*" is itemized so as to clearly distinguish between *Rentals, Interest* and *Sinking Fund* charges. It should be noted that there are excluded both from "*Other Income*" and from "*Deductions from Gross Corporate Income*" the receipts and disbursements on account of funds held as reserves or sinking funds. These transactions are

[1] Including outside operations.

recorded in entirely separate accounts. Thus, dividends received on securities held in sinking or reserve funds are not a part of "dividend income." These receipts are credited to a separate account, "Income from Sinking and other Reserve Funds."

Under the fourth general account, *Disposition of Net Corporate Income* are included dividends on capital stock and appropriations for "Additions and Betterments," and for "Reserves" charged against the *Income Account.* It is discretionary with the railroad company whether these deductions are made in the *Income Account* or in the *Profit & Loss Account.* In either event, the net result is the same. To determine the full extent of these charges in any period, however, requires careful examination of both the *Income Account* and the *Profit & Loss Account.*

Details of Operating Accounts. The principal items under the general account, *Operating Income,* in the Interstate Commerce Commission's classification are as follows:

Operating Revenues:

- Freight,
- Passenger,
- Passenger-Other,
- Mail,
- Express,
- Miscellaneous Transportation,
- Revenue from Operations other than Transportation,

Total Revenues,

Operating Expenses: [1]
- Maintenance of Way and Structures,
- Maintenance of Equipment,
- Traffic Expenses,
- Transportation Expenses,
- General Expenses,

Total Expenses,

Net Operating Revenue,

The classification of these items of operating revenues and expenses affords opportunity for detailed comparative analysis of any railroad's business with a view to determining the trend of earnings and the standards of operating efficiency. Of course, not all the items are of equal importance. Freight and passenger revenues far exceed the other classes of earnings, which, largely because of their incidental character, may be conveniently grouped together as "miscellaneous" operating revenues. Similarly, among the *Operating Expenses,* the two classes of "maintenance" costs and the *Transportation Expenses* form the great bulk of the expenditures. *Traffic Expenses* cover merely the costs incurred in retaining and fostering the business of the railroad. The *General Expenses* are the unallocated administrative costs of the company. They cover general office and legal expenses, insurance and relief department costs.

The items grouped under "*Outside Operations*"

[1] The Interstate Commerce Commission has under contemplation a revised scheme of operating accounts whereby the expenses are subclassified as *freight, passenger* and *joint.* The practical success of this scheme is very much in doubt.

are inconsiderable amounts compared with those of "rail" operations. The details, therefore, have no particular significance. The operation of dining car service, hotels, restaurants, grain elevators and other services incidental to transportation, are chiefly responsible for the items under the "*Outside Operations*" account.

The grouping and consistent arrangement of the items that follow the operating accounts dispenses with the necessity for further comment on the prescribed form of the *Income Statement.* A correct understanding of the substance of the various groups of income and outgo is as essential in gauging real earning capacity as their logical and systematic sequence.

Standard Units of Operating Receipts: In studying railroad income accounts attention is naturally first given to the operating receipts commonly known as "gross earnings." This general item can be successfully analyzed on the basis of acceptable standard units. The simplest linear unit, viz., "*mile of road*" is most frequently employed. Herein is centered the greatest misuse and abuse of railroad statistics. Although useful for purposes of compiling general railroad data, the "*mile of road*" is highly unsatisfactory as a gauge of business progress, or as a basis for computing relative earning power. On almost all railroad systems in the United States, a "*mile of road*" today represents larger capital investment and greater concentration of engineering skill than a decade or even a half-decade ago. Not only are

extra main and side tracks constantly being added, but, as has already been pointed out, the physical structure of the track and roadbed is also undergoing progressive improvement enabling the handling of greater volumes of traffic. Thus, even on the same railroad the "*per mile of road*" unit is of limited value in correctly estimating trend of earnings. When it is a question of comparative analysis of two or more railroads, the utility of the "*mile of road*" standard is almost totally destroyed by reason of the utter lack of homogeneity due to disparities in extra track mileage. Very few roads have the same ratio of extra main tracks or are provided equally with physical facilities for handling the same volume of traffic.

A more satisfactory standard is found in the "*per mile of single track*" unit. This is based on total main track miles, including second, third and other main tracks, *but not sidings in yards and stations.* The companies are thus statistically comparable in the relation of main track to earnings. Other physical disparities, however, such as the presence or absence of grades, tunnels, terminal yards, sidings and the like also have an important bearing on earning capacity.

Some defenders of the "*per mile of road*" unit for measuring earnings contend that a railroad's business determines the proportion of extra track mileage. Extra main trackage, therefore, can be ignored in gauging gross revenues. Actual railroad conditions do not bear out this theory. The Erie Railroad, for

example, though not so well provided with track facilities, has a larger gross revenue *per mile of road* than the Baltimore & Ohio, and its freight earnings *per mile of road* exceed those of the New York Central. For the fiscal year ended June 30, 1911, the gross earnings of the Baltimore & Ohio per mile of road were $19,881, whereas the Erie reported $23,762. In the same year, the Erie hauled 3,039,900 tons one mile for each mile of road operated, compared with 2,639,654 *ton-miles* on the Baltimore & Ohio and 2,610,980 *ton-miles* on the New York Central. The Southern Railway, in the fiscal year 1911 had 1.29 miles of track, (including sidings), *per mile of road* against 1.22 miles of the Atlantic Coast Line. Southern's freight density, however, was 580,591 ton-miles compared with Atlantic Coast Line's 395,273, or greater by 47 per cent. Of course, the Coast Line carries a greater proportion of high grade freight which offsets to some extent its lower traffic density.

The "*per mile of road*" or "*per mile of track*" units are not the sole guides in comparing earnings. The "*train-mile*" basis is also of assistance. The use of this standard in comparisons, however, should be restricted to lines having similar traffic. The same consideration applies to the use of the "*locomotive-mile*" as a gauge of earning capacity. This unit presents the further difficulty that the size and hauling capacity of locomotives in different years or on different lines may vary. Moreover, in both the "*train-mile*" and the "*locomotive-mile*"

averages it must be assumed that the passenger revenues bear a fixed ratio to the freight earnings—a condition not prevailing in railroad operations.

Operating Expenses. As an indication of efficiency affecting managerial skill and financial uniformity, much dependence is placed on the character of the operating expenses. This arises not because operating expenses are a more important factor in the determination of net income than gross revenues. In fact, it is clearly demonstrable that *under normal conditions an increase in gross earnings is a greater financial advantage than proportionate reduction in operating revenues.* This is due to the fixity of a large part of operating costs. All railroad expenses do not fluctuate in accordance with the amount of business done. In most undertakings, there are certain fixed costs which must be met regardless of the amount of the business or of the revenue. There are also expenses which fluctuate *directly, though not necessarily proportionately,* with each increase or decrease in the units of service performed. Hence, in reducing expenses during dull periods only a part of the operating costs can be materially altered.

In view of this condition, it is obvious that the total operating charges in relation to each traffic unit diminish as the traffic grows larger and increase as the traffic becomes smaller. A greater net return, therefore, is afforded by expansion of revenues than by reduction of expenses. *Operating expenses, how-*

ever, are, at least, partly subject to the control of railroad managers, whereas, the revenues are usually the result of business conditions and natural forces. More attention is, therefore, given to the analysis of costs of operation than to fluctuations in gross earnings.[1]

Classification of Operating Expenses. For analytical purposes, the five sub-divisions of operating expenses adopted by the Interstate Commerce Commission, viz.:—*Maintenance of Way and Structures; Maintenance of Equipment; Conducting Transportation;*

[1] Wellington in his standard treatise on Railway Location places the proportion of expenses that are fixed regardless of amount of traffic at 50% of total operating costs; proportion of expenses that are affected only slightly by increase of traffic at 40% and the proportion of expenses affected directly and proportionately by increase or decrease of traffic at 10%. His illustration of the effects of this condition on net income through increase or decrease of revenues is as follows:

	Normal basis		*Increase of 10% in gross revenue*	*Decrease of 10% in gross revenue*
Gross Earnings. . . .	100.0%	$7,000. .	$7,700	$6,300
Exp. Unaffected . . .	33.3%	2,333. .	2,333	2,333
" Slight. Affect.	26.7%	1,867. .	1,870	1,850
" Fully "	6.7%	467. .	510	420
Total Expenses. . . .		4,667. .	4,713	4,603
Fixed Charges.	27.7%	1,800. .	1,800	1,800
Total	92.4%	6,467. .	6,513	6,403
Balance	7.6%	533. .	1,187	*103 Deficit*

From this illustration it will be seen that an increase of 10% in gross revenue, produces an increase of 100% in the balance available for dividends, whereas, a decrease of 10% in revenues causes a deficit.

Traffic, and *General Expenses*, may be classed under two groups: (1) *Maintenance Expenses* embracing the first two sub-divisions, and (2) *Transportation Expenses*, which include all the other operating costs. The basis of this classification is simple. Maintenance can be increased, reduced or deferred to a large extent by the will of the management, whereas, other operating costs are constantly recurrent and are not greatly influenced by managerial policy. Money that goes into maintenance retains the value of the assets. It is a renewal of capital. Excessive maintenance is like a reserve fund which can be drawn upon in lean times. Excessive expenditure in handling and moving traffic, however, or in administration is once and for all time spent and has no more earning power. Even though liberal maintenance outlay is not always reflected in increased operating efficiency, never is increased operating efficiency gained when the physical property is permitted to deteriorate.

The Measurement of Maintenance. A proper analysis of railroad maintenance costs requires satisfactory standard units. This applies in comparative analyses not only of different roads, but also of different periods on the same road. The relative expenditures required for proper maintenance of roadway and structures are influenced (1) by the nature and the amount of traffic, (2) by the structural character of the roadbed and track, and (3) by the geographical and geological conditions of the territory. A double track road costs more to maintain than one of single track. It does not follow, however, that the expense

should be twice as much. Furthermore, a company having double the traffic density of another, though operating in the same territory and under similar conditions, is not expected to have double the amount of outlay for upkeep. It is plainly evident that much of the physical deterioration of roadway and superstructure is independent of the amount of traffic. Moreover, a favorable topography accessible to construction materials, and an efficient labor force make a marked difference in the maintenance costs on a road possessing these advantages when contrasted with another lacking some or all of them. It can be readily conceived, therefore, that in measuring maintenance no one arbitrary standard can be relied on safely. A combination of various standards is a better guide.

The standard unit most commonly used in the analysis of maintenance-of-way expenses is the "*mile of road.*" When two or more railroads are compared and each, traversing the same territory, is in similar physical condition and do the same amount of business this average may be found useful. However, the "*mile of main track*" as a substitute for "*mile of road*" is better adapted to comparative purposes. There is a rule which assumes that two miles of *side track* or fifteen *switches* are as costly to maintain as one mile of *main track.* This calculation, though purely empirical, is reasonably accurate for comparative purposes when traffic conditions are given due consideration.

In every case of maintenance analysis it should be

ascertained whether the computation is based on the total miles *operated* by the company or on total miles maintained. This distinction is essential because most of the American railroad systems operate their trains over lines in partnership with other systems or under "trackage contracts." The mileage operated under these conditions may not carry a specific charge which can be allocated to the maintenance account. It all depends on the agreement between the companies using the facilities jointly. If the lessee has no obligation of maintenance, the mileage thus operated under "trackage rights" is not to be included in computing the mileage maintained. Thus, the Southern Railway operated, during the year ended June 30, 1911, an average of 7,042 miles of which 6,573 were maintained by the company. The remaining 469 miles were operated under agreements not involving a direct charge for upkeep.

Useful checks on the *per mile of track* and *per mile of road* units for gauging railroad upkeep are the "*train-mile*" and "*ton-mile*" averages. The fact that these units lack homogeneity militates somewhat against their statistical value. Moreover, maintenance expense is influenced by the relative proportions of the passenger to the freight business as well as by traffic density. Disparities in these factors require caution in the use of traffic averages as a measure of maintenance.

To illustrate the methods of gauging maintenance-of-way expenditure, the Southern Railway, the

Atlantic Coast Line and the Seaboard Air Line are selected for comparison:

Year ended June 30th, 1911	*Southern Railway*	*Atlantic Coast Line*	*Seaboard Air Line*
Miles of Single Track per mile of road................	1.29	1.22	1.23
Ton-miles per mile of road...	580,591	395,273	420,031
Maintenance of Way, etc.:			
Per Mile of Single Track Operated...............	$ 821	716	762
Per Mile of Road Maintained..................	$ 1,140	863	934
Per Thousand Ton-miles....	$ 1.83	2.21	2.22
Per Revenue Train-mile.....	$ 22.91	24.13	25.91

By reference to the above standards it appears that the Atlantic Coast Line's upkeep is on a lower scale than that of the other two systems. On a *per-mile* basis the Southern's expenditure is the largest, though, when measured with respect to performance, (*i. e.*, by *train-miles* and *ton-miles*), it falls behind both the Seaboard Air Line and the Atlantic Coast Line. However, the Southern's heavier traffic density would naturally reduce its costs per traffic unit, for though the aggregate expenses of operation increase as traffic increases the rate of increase is at a slower ratio. Even with this consideration, however, we must hesitate in granting the prize to the Southern. Our conclusion may be statistically sound but may lack absolute correctness because of failure to consider differences in operating

conditions. The disturbing element in our analysis is the fact that the Southern Railway Company operates largely through mountainous sections where the effects of natural wear and tear are intensified and where the difficulties of upkeep are enhanced. The Seaboard Air Line and the Atlantic Coast Line traverse, for the most part, a flat, tidewater country, favorable to low-cost maintenance. To what extent allowance should be made for topographical and geological disparities is frequently impossible of determination. The best that can be done by the analyst is to know where to place the handicap and to see that the statistical results obtained are not impaired by disparities in attending circumstances.

Equipment Maintenance. The selection of proper standards in gauging equipment maintenance, whether from the standpoint of adequacy or of operating efficiency, is of great importance in railroad management. The commonly used standards for locomotive maintenance are *cost per locomotive,* or *cost per locomotive-mile.* The value of these units in comparisons, however, may be completely destroyed by differences in the size of locomotives, in the operating conditions, or in the nature of tonnage hauled. The same objections apply to comparisons of both passenger and freight car maintenance. Not only do cars and locomotives of different railroads vary in average size and quality, but some lines are better supplied with equipment than others. Those which are relatively richest in rolling stock

naturally require less maintenance expenditure per unit of equipment.

It is evident that considerable caution is demanded in selecting proper standards for measurement of equipment maintenance. As already pointed out with reference to maintenance-of-way expenditures, possible disparities in the various factors should be ascertained before making comparisons. When differences in conditions are found which may vitiate the selected standard units, others should be employed. Thus, when there is considerable disparity between the *average tractive power per locomotive* on two different lines the *maintenance cost per locomotive* should be substituted by some other standard as "*maintenance per pound of locomotive tractive power.*" If it happens that on one road the average number of miles run by each locomotive per annum is decidedly in excess of the same average on another line, the "*locomotive maintenance cost per locomotive-mile*" may be of value as a test of upkeep. To obviate the disturbing effects of disparities in both the size of locomotives and in the locomotive performance, the units *maintenance cost per locomotive-mile* and *cost per pound of tractive power* may be combined as shown on the opposite page.

It would seem merely from the comparative statement that on the basis of the locomotive unit the Southern expended a slightly larger sum for locomotive upkeep than the Atlantic Coast Line, and less than that of the Seaboard Air Line. The slight excess over Atlantic Coast Line may arise, however,

COMPARATIVE LOCOMOTIVE MAINTENANCE EXPENDITURES

Year ended June 30th, 1911	*Southern Railway*	*Atlantic Coast Line*	*Seaboard Air Line*
Average tractive power per locomotive, pounds......	32,300	20,560	25,920
Maintenance of Locomotives:			
Per Locomotive..........$	2,599	2,252	2,721
Per Locomotive-mile.... cts.	9.44	7.12	8.45
Per pound tractive power cts.	8.76	11.08	10.80
Per Locomotive-mile per thousand pounds of tractive power........cts.	.3182[1]	.3501	.3170

from the larger size of the Southern's locomotives. This is plainly evident when the computation of maintenance is based on the *tractive power* unit for, in this respect, the Southern falls behind both the Seaboard and the Coast Line. But, on the basis of the *locomotive-mile*, the Southern, with 9.44 cts. shows a higher average than the Seaboard and the Atlantic Coast line with 8.45 cts. and 7.12 cts., respectively. When, however, the computation of locomotive maintenance cost is made on the combined basis of performance and of size of locomotives (*per locomotive-mile per pound of tractive power*) the Atlantic Coast Line shows the highest average in spite of the fact that it expends less *per locomotive* for upkeep than the other two railroad systems. This analysis demonstrates the caution necessary in basing judgment on the use of a single statistical standard. Each separate test

[1] Approximately.

requires further confirmation by the application of additional standard units.

In computing the scale of passenger and freight car maintenance costs, the same methods may be followed as in the study of locomotive upkeep. Here, also, we may take for illustrative purposes the three leading southern systems:

FREIGHT AND PASSENGER CAR MAINTENANCE

Year ended June 30th, 1911	*Southern Railway*	*Atlantic Coast Line*	*Seaboard Air Line*
FREIGHT CARS, number	51,846	25,205	14,844
Average capacity per freight car (tons)	35.1	28.7	33.9
Revenue Ton-miles per ton of capacity	2,169	2,301	2,550
Maintenance per freight car $	82	89	73
Maintenance per car-mile cts.	.98	1.05	.80
Maintenance per ton car capacity cts.	2.46	3.12	2.17
PASSENGER CARS			
Maintenance per car $	758	916	880
Maintenance per passenger car-mile cts.	1.02	1.26	1.11

It appears that the Atlantic Coast Line expends relatively more for passenger and freight car upkeep than the other two systems. Before accepting this conclusion, however, inquiry should be made concerning the equipment supply of each company relative to traffic. The more equipment used for moving a given volume of freight the less ordinarily

will be the wear and tear per equipment unit. An examination of the Atlantic Coast Line's freight car facilities does not reveal an appreciable difference in this respect from the other two companies. Thus, the Atlantic Coast Line had one ton of car capacity for every 2301 *ton-miles* of revenue freight, whereas, the Southern had one ton capacity to 2169 *ton-miles* and the Seaboard Air Line had one ton capacity to 2550 *ton-miles*. Of course, there are other factors which might destroy the correctness of the statistical comparison. For example, it is possible that the cars of one railroad system are largely of steel construction. This equipment requires relatively less repair expense than old type wooden cars. Again, one company may have its repair shops well managed and conveniently distributed along its lines, whereas, another line may not be so well provided with repair facilities and may find it necessary to give its damaged equipment over to outside concerns for repair.

The policy of each railroad company in setting aside reserves from earnings to cover equipment depreciation is an influencing element in upkeep expense. At this writing, the Interstate Commerce Commission, though requiring depreciation accounts, has instituted no definite rate or amount to be periodically applied as depreciation. This matter is therefore discretionary with the individual railroad companies. The annual renewal expense is likewise largely a question of policy with the railroad management. The "scrapping" and replacing of old and worn-out equipment can take place when ordered by

operating officials. It is not regularly recurrent as ordinary repairs. Accordingly, in analyzing equipment maintenance expenses, it may be well to separate the "*renewal*" and "*depreciation*" items from the cost of repairs, though the most satisfactory calculations are based on a combination of the three general items, "*repairs, renewals,* and *depreciation.*"

In all studies of maintenance expense, the "human factor" should not be overlooked. The general discipline among all employees as well as the efficiency of the mechanical departments of the railroads may effect a considerable reduction in repair costs without in any way lowering the standard of upkeep. A recent careful investigation of freight car damage has led to the belief that more than 50 per cent. of such losses are due to unfair usage and rough handling. When employees, through discipline and good management, refrain from abusing equipment, repair bills are reduced and the life of equipment is extended beyond the general average. Much of the large capital outlay required by the purchase of durable equipment, such as heavy, all-steel cars might likewise be obviated. All this tends to widen the margin of railroad profits.

The common practice of "hiring" equipment, likewise, influences car repair costs. Under the prevailing system of freight car interchange the owning company usually pays for repairs arising from the ordinary wear and tear of equipment due to use. The borrowing line pays only for repairs due to rough

handling, wrecks and fire. Accordingly, the rental for hired cars theoretically covers interest, depreciation and ordinary repairs. But under the Interstate Commerce Commission's rules no portion of the car rental is credited to car repairs. It is therefore evident that in the case of a road owning 1,000 cars and borrowing 500 foreign cars the cost of keeping up repairs is less per unit than if all the 1,500 cars were owned. The owning road, on the other hand, will have a relatively higher cost per unit since its repair account is charged with the wear and tear of service given to another line. Of course, the rental received may reimburse the owner, but this is not a factor in the maintenance computations. Thus, cost of repairs *per car* as usually figured may be misleading. A casual inference that a company has made a good maintenance showing may be reversed by a careful analysis.

The correct computation of equipment maintenance costs is of the highest economic importance to the railroads. In this department, lack of close observation and managerial skill produce wastes and losses seriously impairing earning power. The experiences of both the Atchison and the Illinois Central railroads are cases in point. The Illinois Central in 1907, began to "farm out" its freight cars for repairs with the result that the cost of freight car upkeep increased steadily, jumping from $3,924,296 in 1906, to $7,975,992 in 1910. An investigation finally revealed that gross frauds had been practiced in the company's repair department. Had the company's

directors compared its freight car maintenance cost with those of competing companies, the condition of affairs might have been discovered much sooner. The stockholders might have been spared the heavy loss, estimated in some quarters, as high as $6,000,000. Thus, a comparison of freight car maintenance of the Illinois Central, the Cincinnati, New Orleans & Texas Pacific, and the Mobile & Ohio would have shown: [1]

Year	Illinois Central		Cin. N. O. & T. Pac.		Mobile & Ohio	
	Per Frt. car	*Per Frt. car mile*	*Per Frt. car*	*Per Frt. car mile*	*Per Frt. car*	*Per Frt. car mile*
1908	$ 86.02	1.03c	$91.47	1.63c	$75.92	0.72c
1909	99.08	1.28	69.72	1.17	60.53	0.66
1910	130.22	1.51	78.04	1.20	94.94	0.99

The pronounced increase in Illinois Central's freight car maintenance costs in 1909 and 1910 would seem to indicate a "leakage," without reference to similar costs on rival systems. By making a comparative analysis, however, and allowing for possible disparities due to differences in attending circumstances, evidence of fraud becomes clearly manifest.

[1] The computations are taken from Messrs. Price, Waterhouse & Company's excellent compilation of Railroad Statistics. The averages are arrived at by dividing the total "Repairs, Renewals and Depreciation" accounts, as shown under the heading "Maintenance of Equipment," by the number of units of each class of equipment on hand at the beginning of the year.

Conducting Transportation Costs. The transportation costs are the items of expense directly incurred in moving the traffic. As has already been pointed out, they differ in character from maintenance expenses; first, because they cannot be arbitrarily adjusted and, secondly, because when once paid out no value remains to represent the outlay. These fundamental distinctions make it evident that all possible economy consistent with service should be practiced in conducting transportation. As many operating costs are unaffected by volume of business, increase in gross earnings, other things being equal, should result in a smaller ratio of operating expense to earnings. *The ratio of the cost of conducting transportation to operating revenues is, therefore, a good index of efficiency when not accounted for by changes in rates or in operating conditions.* As between different railroads, however, caution must be exercised in using this index. Local conditions as well as disparities in kind and in amount of traffic affect transportation costs to an even greater degree than maintenance costs. Fast and frequent freight service requiring light train-loads increase transportation costs. Similarly, heavy grades, insufficient trackage, weak bridges and the like cause loss in speed and in service. All this means larger wage and fuel costs than when physical facilities permit the maximum speed and the minimum time. On the other hand, the relatively smaller transportation costs resulting from improved physical facilities are generally effected by heavy increase in the

permanent capital investment in the property. The heavier interest and dividend charges on capital investment may therefore wholly offset the saving in operating expense. The great problem always before the railroad financier is to determine how far the saving in transportation and in other costs arising from proposed improvements and betterments will outstrip the cost of the new capital required for these purposes.

The very nature of the transportation expenses, (*i. e.*, the impossibility of physically tracing their results on the property), affords opportunities for waste and extravagance. Consequently, their close supervision and proper measurement is of great value to railroad managers and investors. This is particularly true at the present time when railroad operations are circumscribed by government regulations and susceptible to the scrutiny of expert analysts and efficiency engineers. The Interstate Commerce Commission has publicly announced that no increase in freight rates would be sanctioned until it was proven that all possible efforts towards economy in operations had been made by the companies.[1]

Through economy experiments conducted by the railroads, and through the activities of efficient executives, some splendid results in reduction of transportation costs have been obtained. In view of the Government's attitude in rate-making further progress along these lines may be expected. The

[1] See In re Investigation of Advances in Rates by Carriers in Official Classification Territory No. 3400.

investor in railroad securities will enjoy the benefits, however, only in so far as the economies effected by the company in which he is concerned are equal to or in advance of the general standards obtaining among all railroad companies.

Locomotive Fuel Expense. One of the largest items among the transportation costs is locomotive fuel. This item consumes, approximately, 10 per cent. of the gross railroad earnings, and the railroads in the aggregate use about one-fourth of the total coal production of the country. The fuel cost to railroads in the United States now exceeds \$200,000,000 annually, or about \$4,000 per locomotive. For individual railroad systems, the locomotive fuel comprises from 20 per cent. to 35 per cent. of the total expenses grouped under "*Conducting Transportation.*"

In view of the upward price tendency of fuel materials an analysis of this item from year to year, particularly in reference to locomotive performance, is worthy of close attention. Fuel economy means not only reduced fuel expense, but also increased hauling capacity in proportion to the weight of the locomotive. It means less difficulty in firing locomotives and more reserve power for making up time and for handling trains in bad weather. Accordingly, the possibility of decreasing fuel costs presents a promising field for scientific investigation and experimentation. Data regarding locomotive fuel expense generally can be found in railroad reports under the statistics of locomotive performance.

Thus, the Erie's reports for the fiscal years 1909 to 1912, inclusive, contain the following relative to locomotive fuel:

Locomotive Fuel Statistics	*1912*	*1911*	*1910*	*1909*
Pounds consumed per locomotive mile.	168.1	168.8	170.4	174.0
Cost per locomotive-mile.	12.46c	12.19c	12.04c	12.26c
Cost per 1,000 ton-miles	15.57c	15.27c	16.06c	15.27c

There is here some evidence of better fuel economy, for notwithstanding the larger size of locomotives, the consumption of coal per locomotive-mile was 5.9 pounds less in 1912 than in 1909. The cost per *locomotive-mile*, however was 20c. more. The cost *per thousand ton-miles*, in 1912, was also more than in 1909, though slightly below that of 1910.

WAGES. Wages constitute another leading expense in conducting transportation. Opportunities for economy under this heading are not as available as with other expense items. The strong organizations of railroad employees engaged in the moving of traffic enhance their ability to command compensation as great, if not greater, than prevails among other classes of workers of similar standing. This forces the railroads to economize by promoting efficiency among their working forces. A highly disciplined force of employees undoubtedly contributes to economies in transportation operations which more than offset the high wage cost. It is evident, therefore, that reductions in the wage pay-

ments to employees are not always an indication of more economical and efficient management.

The Operating Ratio. The percentage of the total *operating expenses* to the *operating revenues* is designated by railroad statisticians as the *Operating Ratio.* This is generally considered a valid index of economical handling of the railroad's business. In this respect, however, its value is liable to exaggeration. Considered by itself, without reference to the various conditions and factors influencing operating costs, the "Operating Ratio" is absolutely worthless. In the first place, error can easily be made in comparing operating ratios of different systems by reason of opposed financial policies in the roads compared. For example, the operating ratios would not be comparable in the case of two systems one of which charges as much of permanent improvement expenditure as possible to "repairs account" and the other as little as possible. Secondly, a large proportion of low grade tonnage moved at a cheap rate over a line of light traffic causes a high operating ratio. Thus, an increase of branch mileage, with but few exceptions, leads to higher operating ratios. Low grade tonnage, however, when combined with heavy traffic density and a capacity for doing the business, may mean a profitable net return on capital even at a high operating ratio. On the other hand, a low operating ratio with a light traffic density may afford no return at all on capital investment. In fact, many of the standard dividend pay-

ing railroads that do a heavy business have larger operating ratios than their nondividend paying rivals. On the other hand, companies whose tonnage includes high-class commodities of small bulk, but which involve costly transportation service are likely to have high operating ratios, without a detriment to good earning power. Thus, the Chicago & North Western had an operating ratio in 1911 and 1912, respectively, of 71.5 per cent. and 70.8 per cent. compared with but 61.4 per cent. and 56.9 per cent. on the Great Northern. But the Chicago & North Western carries a much smaller proportion of low grade freight and a considerably larger amount of package freight (merchandise). It has also a heavier passenger business than the Great Northern. All these factors are conducive to a higher operating ratio, but do not necessarily imply inferior earning power.

With intensive development of transportation facilities there is a natural tendency for the *operating ratio* to increase. In all business enterprises, the margin of profit in the exchange of commodities or of services is largely dependent on the rapidity of the "turnover." By "turnover" is meant the relative time required in converting the capital "locked up" directly in the manufacture or sale of commodities or in the performance of a service back into its original substance, "cash." A grocery merchant, who changes his stock in trade an average of twelve times a year, other things being equal, will earn the same rate on his capital as a jewelry merchant whose

stock changes but once a year, but whose margin of profit on each sale is twelve times that of the grocer. This condition applies to railroad operations. The large investment of railroads in fixed property adds to the economic importance of doing a maximum business in the minimum time, even though the average margin of profit on the services performed may be thereby reduced. A railroad company that doubles its traffic without increase in permanent investment will earn as much for its stockholders on a 12½ per cent. margin of profit as on a 25 per cent. margin with half the business. Under the old conditions, however, its operating ratio was 75 per cent. but for the purpose of doubling the business, it becomes just as profitable to work under an operating ratio of 87½ per cent. In this event, an increased operating ratio is no loss to the railroad and a direct gain to the public.

When outside business circumstances and operating conditions undergo no pronounced change, the *operating ratio* may be used as an index of efficiency on the same railroad over a period of years. Its proper use, however, requires caution. Aside from accounting changes, the general ratio of expense to revenues may fail to indicate changes in maintenance and in operating policy, or in the physical substance of the property and equipment. Extensive improvement work on railroad lines interferes with traffic operations and thus causes a pronounced increase in the *operating ratio.* The human factor as an element should likewise not be overlooked.

Economy at the expense of efficiency is a loss, though it may result in lowering the *operating ratio.* A high standard of service, a well paid, well disciplined force of employees, and a well maintained property, are of more permanent value than temporary show of large earning capacity.

In making a comparative analysis of the *operating ratio* from year to year an advantage is gained by separately considering the five main divisions of the *operating expenses.* In this way is determined how far each group has contributed toward an increase or a decrease in the general ratio. Thus, the Baltimore & Ohio Railroad's operating ratio for the fiscal years 1908–1911, inclusive, has been as follows:

Percentage of gross earnings expended for	Baltimore & Ohio Railroad			
	1908	*1909*	*1910*	*1911*
	%	%	%	%
Maintenance of Way and structures	14.37	12.69	13.12	11.66
Maintenance of Equipment	17.51	15.46	18.42	18.02
Traffic Expenses	2.27	2.26	2.11	2.21
Conducting Transportation Expenses	37.66	34.41	33.45	37.23
General Expenses	2.08	2.08	1.89	2.08
Total Operating Ratio	73.89	66.90	68.99	71.20

A study of the above table shows that the high operating ratio in the year 1911 was caused by increase in the proportion of transportation costs. The maintenance expenses combined, in 1911, were

29.68 per cent. against 31.54 per cent. the previous year, whereas, the transportation expenses amounted to but 33.45 per cent. in 1910, compared with 37.23 per cent. in 1911, and as against 34.41 per cent. in 1909. By thus separating the principal factors of the *operating ratio,* the trend and fluctuations in maintenance and other expenses can be readily traced. This must always be done in order to determine operating efficiency by means of the general ratio. Otherwise, the standard is meaningless.

Net Operating Revenue. The deduction of the "*Operating Expenses*" from the "*Operating Revenues*" gives the "*Net Revenue from 'Rail' Operations,*" or "*Net Operating Revenue.*"[1] Except in small and unimportant systems this item does not indicate the extent of earning capacity or the return on capital investment. The fact that one company has net operating revenue "*per mile of road*" or "*per train-mile*" twice as great as another does not necessarily indicate that the profitableness of the business of the first is greater. The Erie Railroad's net operating revenue "*per mile of road*" is about six times that of the Atlantic Coast Line. Yet, the latter company, because of the low construction cost of its property and conservative capitalization, affords a better return on actual investment than the Erie.

[1] There is an absence of uniformity in the use of the terms "*Net Operating Revenue*" and "*Operating Income.*" According to the Interstate Commerce Commission, the latter represents the balance of the "*Net Operating Revenue*" after the inclusion of the net income or net deficit arising from "*Outside Operations*" and after the deduction of "*Taxes Accrued.*"

The growth of net revenue in relation to capital investment in the railroad is an important factor in gauging financial progress. Although both gross and net earnings of a railroad system may be constantly expanding, the gains along these lines may not compensate for the additional capital utilized in producing the improved operating results. Increased traffic density, heavier car loading and the progressive betterment in transportation facilities have promoted the expansion of railroad revenues. This is the natural effect of growth in wealth and population. *Financial interests, however, are unfavorably affected if the result has been obtained with larger capital expenditure than is warranted by the increased profits.*

The financial troubles of the Wabash Railroad illustrate this point. During the years 1905–1912 the gross and net earnings of the Wabash underwent considerable expansion. Without change in mileage, net operating revenue grew from $4,987,025 in 1905 to $7,517,854 in 1911, a gain of about 60 per cent. In the meantime, however, the charges against income increased enormously. These fixed charges, because of necessary expenditures to keep the railroad in efficient condition, could not be met. A receivership and reorganization is the usual outcome of this condition.

Taxes. According to the ruling of the Interstate Commerce Commission, "Taxes" are separated from "*Operating Expenses*" and are deducted from "*Net Operating Revenue*" so as to obtain the "*Operating*

Income." The underlying basis of this ruling lies in the fact that taxes, unlike other railroad expenditures, are determined by political authority and not by the policy of the railroad directors, or by the exigencies of the transportation service. Moreover, taxes are "fixed" charges against railroad revenues and take precedence over all other liens on property and earnings. The item "*Taxes*" in the *Income Statement*, therefore, is worthy of close attention in the study of railroad earnings. Practically all important transportation systems are subject to the varying tax laws of two or more states. Lack of uniformity and frequent changes in taxing methods afford no certainty of the aggregate amount any company may be assessed for public revenue. The contrasts in the scale of railroad taxation in the various states is most striking. An official computation made some time ago showed variations in the percentage of taxes to railroad gross earnings ranging from 2.7 per cent. up to 4.8 per cent. the lowest being in a group of states made up of Maryland, Pennsylvania, District of Columbia and Delaware, and the highest in the group made up of Connecticut, Maine and Rhode Island. In percentage of taxes to *net* earnings the range was from 6.9 per cent. in a group of states made up of California, Nevada, Oregon, Utah and Washington, to 17.3 per cent. in Connecticut, Maine and Rhode Island.[1] Another computation based on returns of 13 important railroad systems showed a variation in ratio of taxes to gross earnings ranging

[1] "The (London) Times American Railway Number," 1912, p. 30.

from 2.5 per cent. on the Erie Railroad system, to 6.3 per cent. on the New York, New Haven & Hartford property. A few states, particularly Connecticut, base taxes on market value of the shares of the taxed corporation. When the securities command higher prices the taxes are greater. There is a tendency in some cases to lighten the taxes of non-dividend paying railroads. Moreover, prevailing publicity of railroad accounts would seem to enable public officials to judge properly the net earning power of each railroad and what is a reasonable assessment for taxation.

For their own convenience and in order to show the portion of their revenues assessed for governmental purposes, a number of railroads compute their annual tax payments as a percentage of gross earnings. In view of the fact, however, that some states base tax rates on the average "*per mile*" valuation of railroad property, a "*per mile of road*" computation is also used. There can be no doubt that, notwithstanding the enhancement in the value of railroad property and the almost uninterrupted expansion in railroad earnings, heavier taxation is becoming an increasing burden to the companies. Even though railroad net income may not be seriously impaired thereby, railroad shareholders suffer a permanent loss.

CHAPTER X

NET INCOME AND ITS DISTRIBUTION

Operating Income. "*Operating Income*" as indicated on page 187 is the balance after the deduction of "*Taxes*" from "*Net Operating Revenues.*" The item represents the financial result obtained from the direct operation of the railroad property, without reference to investment or to other activities, and without deduction of capital charges in the form of interest, rentals and dividends. It, therefore, purports to exhibit the net earning capacity of a railroad as an operating company. If American railroad corporations had confined their activities to operating "rail" transportation facilities directly under their own corporate organizations, the "*Operating Income*" would be the item in the *Income Account* attracting the closest interest of security holders. From this "balance" alone would come the interest and dividend payments. However, because of the acquisition of legally independent and separately operated lines, and because of the development of activities not directly connected with or incidental to transportation, additional sources of revenue are added from which payments for the use of capital are drawn.

"*Other Income.*" Attention has already been

called to the fact that American railroad companies are *holding* concerns, *owning* securities of other companies as well as *operating* directly their own corporate lines. The results of these investment activities affect financial progress as much as the direct railroad operating results. In fact, the ownership of subsidiaries affords opportunities of misinterpretation of equities and earning power. For this reason, it is frequently necessary to combine the accounts of railroad companies comprising a "system" in order to properly determine the actual earnings and financial condition of the parent or holding, company.

The New York Central system furnishes an illustration. An analysis of the surplus earnings of the New York Central lines for the calendar year 1910 reveals the following.

Year ended December 31, 1910	*Surplus for the year* [1]	*New York Central's Equity*
New York Central	$ 924,914	$ 924,914
Lake Shore	4,883,065	4,394,758
Michigan Central	593,051	533,745
Pittsburgh & Lake Erie	89,906	44,953
Chicago, Indiana & Southern	314,798	283,318
New York, Chicago & St. Louis	639,823	301,914
Monongahela Railroad	30,245	96,804
Cleveland, Cincinnati, Chicago & St. Louis	34,371	20,124
	$7,910,173	$6,600,530

According to the above computation, the surplus remaining, after all charges and dividends of the

[1] After dividend payments.

New York Central Lines, amounted, approximately, to 3 per cent. of $222,724,400 New York Central outstanding stock. This, combined with the 6 per cent. dividend paid to New York Central stockholders, would have permitted a dividend of 9 per cent. on New York Central stock. Confining the computation to the undistributed surplus of the Lake Shore and the Michigan Central lines, the surplus profits available for New York Central stock would be in the neighborhood of 8 per cent., instead of 6 per cent. as exhibited in the parent company's own income statement.[1]

It is readily apparent that a company controlling other railroads through stock ownership can arbi-

[1] The following table shows the dividends earned by the Lake Shore and the Michigan Central companies on their respective capital stocks since 1905, together with dividends paid, and the equity of New York Central in the surplus remaining after dividends. This equity is computed in percentage of New York Central's outstanding stock.

Year	Lake Shore			Michigan Central		
	Am't Earned	*Div. Paid*	*Approx. equity of N. Y. Central in surplus*	*Am't Earned*	*Div. Paid*	*Approx. equity of N. Y. Central in surplus*
1912	32.2%	18%	3.0%	14.6%	6%	0.7%
1911	28.6	18	2.2	11.3	6	0.4
1910	27.7	18	1.9	7.8	6	0.14
1909	26.1	12	2.9	15.3	6	0.7
1908	18.4	12	1.3	8.6	6	0.2
1907	25.0	14	2.2	9.2	8	0.1
1906	24.0	8	3.2	5.2	5	0.0

trarily draw on the profits and surplus of its subsidiaries. A correct computation of earning power is not limited to analysis of the parent company's accounts. The subsidiaries must also be closely examined to ascertain whether the income credited to security holdings represents a proper application of the surplus earnings of the controlled corporation. Income may be credited without being earned, and it may be earned and not credited.

The Denver and Rio Grande Railroad in 1910 furnishes an instance of a possible misinterpretation of an income statement, through adding to income *accrued*, but unpaid, interest on securities of a subsidiary company. Entirely in conformity with the Interstate Commerce Commission's rules and requirements, the year's interest accrual of $1,152,844 on Denver & Rio Grande's Western Pacific Second Mortgage Bonds was credited as income. As this interest was not actually paid, it is held as a "deferred asset." By reckoning in this fictitious revenue the Denver and Rio Grande could have carried forward a surplus of $1,552,000 instead of reporting an actual credit of approximately $400,000. For doing exactly this, many railroads have come under the severest criticism in the past. The ultimate outcome in some cases was the requirement of receivers.

A great American railroad system which is particularly prominent because of its investment activities is the Union Pacific Railroad. The policy of the late Mr. Harriman in developing and extending Union Pacific lines and in preventing advantages

to other transcontinental railroads was through acquisition of large blocks of stocks in competing and connecting systems. These and other investment holdings amounted in 1911 to a book value in the neighborhood of $260,000,000. The income from this source was $18,398,000, compared with net operating revenue (before deduction of fixed charges) of $35,711,000. The Union Pacific's big return from stocks of other roads held in its treasury has been responsible for a good deal of misconception as to the earning power of the railroad property. As a matter of fact, that company's return on its capital stock as measured by its own railroad operations is not large. In 1912, it was slightly more than one-half the amount needed for its 10 per cent. common stock dividends. Up to 1912, it was customary for the Union Pacific to pay 6 per cent. on its common stock from transportation earnings. The remaining 4 per cent. in dividends was charged directly against income from securities owned.

Deductions from Corporate Income. These include *Rentals*, *Interest* and *Sinking Fund* payments and are familiarly known as the "Fixed Charges." Attention has already been called to the fact that under Interstate Commerce Commission classification, the item "*Taxes*" is deducted directly from the *Net Operating Revenue*. It is, therefore, not among "fixed charges." Taxes are a fixed expense, however, and, for purposes of analysis, may be conveniently grouped with *Rentals*, *Interest* and *Sinking Fund payments*.

Rentals represent, in addition to car-hire expense, the periodical payments for lease or use of railroad lines, terminals and other facilities and are therefore analogous to interest payments. The arrangements under which one railroad operates or uses the facilities of another railroad are matter of contract. Frequently, the rental is nothing more than an agreement to guarantee the payment of stipulated rates on part or all of the securities of the leased concern. In other instances no fixed rental is specified but the surplus earnings of the leased line may be distributed or apportioned between the owners and the lessee according to fixed agreement. Under this arrangement the rental is not essentially a fixed charge though classed under "*Deductions from Income.*"

The nature of railroad *interest* charges requires little explanation. These are generally more 'fixed' in character than the other deductions from net income. The amount each year, accordingly, can be calculated in advance. As pointed out on page 41 a few railroads have income bonds outstanding the interest on which is not required to be paid unless earned. This provision would seem to remove the payments on these obligations from the category of "Fixed Charges." There are only a very few issues of income bonds, however, and no separate classification is made for their interest charge in the *Income Account.* Similarly, the interest paid on unfunded indebtedness, as well as the cost of exchange and discount transactions are included among the "*De-*

ductions from Income" along with the fixed interest charges on capital securities.

Sinking fund and other amortization charges are a relatively unimportant item among the *Deductions from Net Income.* Railroads, as a rule, make no substantial provisions for debt amortization. The exception is in the case of "car trust" indebtedness in which a part of the principal is paid off periodically so as to be wholly amortized before the equipment is worn out.

The *amortization of discount on funded debt* is also an item under *Deductions from Net Income.* Reference has already been made to the regulations of the Interstate Commerce Commission whereby the periodical amortization is proportioned equally throughout the interval between the date of sale and the date of maturity of the obligations on which the discount expense was incurred. However, if the company desires to extinguish the discount sooner, it may do so at its own option through a charge against *Profit & Loss.* As long as any of the discount is unextinguished, a proportionate charge must be made against annual income sufficient to amortize the discount during the interval in which the funded debt remains outstanding.

The miscellaneous items included by the Interstate Commerce Commission under "*Deductions from Income*" are not of sufficient general importance to require description here. The investor, however, should examine the items carefully to ascertain in each case the exact nature of the liabilities charged

against current earnings. Notwithstanding official regulations there are possibilities of omitting or understating charges or losses which, in accordance with correct accounting principles, should be included under the "*Deductions from Net Income.*" Among these are the so-called "contingent obligations" arising either from the guarantee of interest and dividends on subsidiary company securities or from the income deficits of railroads and other concerns which are owned but *operated separately* or which are controlled through majority stock ownership. Liabilities of this character demand attention. Control of subsidiaries is more often for the purpose of furnishing traffic to the main lines than for direct pecuniary gain. Consequently, the operating deficits of such "feeders" are as properly a charge against the general net earnings for the period in which they accrue as is the interest paid on capital utilized directly in increasing traffic. However, because these charges are not "fixed" or regularly recurrent and do not appear on the books of the parent company they are frequently omitted in income calculations. There are instances, however, in which railroad companies regularly take into their income account their proportionate share of deficits in the operations of a controlled road. The Colorado & Southern Railroad, for example, jointly with the Rock Island system, owns the stock of the Trinity & Brazos Valley Railroad, a line furnishing to both systems an outlet to the Gulf of Mexico. The net earnings of the Trinity & Brazos Valley have been

insufficient to pay its fixed charges. Each of the parent companies, therefore, assumes one-half of the annual deficit. During the last four years, this deficit has been in the neighborhood of $1,000,000 annually.

The Yazoo & Mississippi Valley, whose stock is held by the Illinois Central Railroad is an instance of the operation of a controlled line which frequently shows an annual deficit after deduction of charges against income. In this case the Illinois Central is not required to carry the loss into its own income account. The deficits are not regularly recurrent. Moreover, the Yazoo & Mississippi Valley has a *Profit & Loss* surplus against which operating losses may be charged.

Net Corporate Income and the Margin of Safety. After the deduction of all proper charges against current income, the surplus, if any, can be disposed of in accordance with the judgment of the company's directors. This surplus is designated by the Interstate Commerce Commission as "*Net Corporate Income.*" Considered in relation to the funded obligations outstanding, this item determines to some extent the investment values of these securities. Considered solely with reference to the interest requirements, it is commonly termed the "*Margin of Safety.*" Thus, if a company has but one bond issue bearing an annual interest requirement of $100,000, and the *Net Corporate Income* (after all fixed charges and reserve requirements) for a series of years is approximately $100,000 annually, the "*Margin of*

Safety" is said to be 100 per cent. Most railroad companies however, have a number of different bond issues ranging in priority as to claim upon net income, and the "*Margin of Safety*" is frequently calculated with reference to each issue. The relative market standing, other things being equal, is largely gauged by the size of the ratio. Thus, the First Consolidated Mortgage 5 per cent. Bonds of the Southern Railway, having claim upon net income prior to several other direct funded obligations of the company, with a margin of safety in 1912 of about 500 per cent., have sold at 101 when the Development & General Mortgage 4 per cent. Bonds, which are not so well secured, sold at slightly less than 72. The difference in the interest rate, therefore, does not fully account for the disparity in price. Similarly, the First Mortgage 5 per cent. Gold Bonds of the Wabash Railroad sold in January, 1912, as high as 107½, whereas, the First & Refunding Gold 4 per cent. Bonds of the company, on which the interest requirements were at the time barely met from net earnings, sold around 56.

The question as to an "ideal" *Margin of Safety* in the analysis of railroad income statements is of purely academic interest. The wide disparities in operating conditions affecting income stability do not permit the establishment of a definite rule. It is evident from the relative market prices of railroad securities, that a margin of 25 per cent. above fixed charges in one railroad company's income statement is a better basis of security value than a 50 per cent.

margin of another line. Thus, the Boston & Maine Railroad in the fiscal year 1911 had a margin of safety of but 23 per cent. above its fixed interest requirements, whereas the Erie Railroad had a margin of 53 per cent. It would be difficult to argue that Erie's bonds have a better investment value than similar issues of the Boston & Maine. The same is true when comparison is made between the *Margin of Safety* of the Union Pacific securities and those of the Lake Shore and Michigan Southern system. The former has been earning its interest charges four times over, whereas, the charges of the Lake Shore were hardly trebled. Stability of earnings is a factor in market values eliminating the necessity of a large *Margin of Safety.*

Distribution of Corporate Net Income. The surplus income remaining after all "fixed" and necessary charges is available for shareholders' dividends. Dividend distribution, however, as already mentioned, is largely discretionary with each company's directors. The financial policy of standard American railroads differs from that of the English companies in which earnings are divided "up to the hilt" among shareholders, and nothing is reserved for permanent improvements or for contingencies. In the United States vast sums taken from income have been "turned back into the property." The stockholders thus do not reap the immediate and direct benefit represented by the earning power back of their securities. The Pennsylvania Railroad's directors for many years are said to have adhered to the dictum,

"A dollar for improvements for each dollar in dividends." Through this means they have built up an aggregate surplus of more than $100,000,000 (which does not include the surplus accounts of its subsidiaries). In addition, large sums have been put into property directly through charges to operating expenses. The Chicago, Burlington & Quincy has likewise accumulated through earnings a surplus of over $60,000,000, applied largely to permanent improvements and additions. The Atlantic Coast Line during the decade ended June 30, 1912, had net earnings available for dividends of $48,292,000, of which only about one-half was paid to stockholders. The remainder served as additional capital for railroad operations.

Guided by the success of this policy, several of the less prosperous companies, though showing surplus earnings sufficient for dividend payments, have been withholding a full distribution to shareholders in order to strengthen their finances and credit. For example, the Erie had surplus net income in the fiscal year 1911 sufficient to meet the preferred dividend requirements and to pay, in addition, a dividend of 2.5 per cent. on its common stock, but no class of shareholders participated in a distribution. In the same year, the Southern Railway also had a surplus above fixed charges of $6,670,000, of which but $1,200,000 (a dividend of 2 per cent.) was paid to preferred shareholders, the remainder having been applied to strengthen the financial position of the company. A conservative dividend policy of this

sort is expected to enhance the intrinsic merits of the shares of such companies even though the owners are receiving no immediate return.

It is thus a common practice among American railroad companies to apply each year a part of the *Net Corporate Income* directly to the uses of the property. Sums so set aside are called "*Appropriations from Income*." In accordance with Interstate Commerce Commission regulations these appropriations are to be permanently credited to an account called "*Appropriated Surplus*" so as to be distinguished from the "*Profit & Loss*" *Surplus*.

The purpose of withholding a full distribution of the *Net Corporate Income* from shareholders is to prevent a large increase in capital obligations. In this way the railroad's credit is improved. The late President McCrea, of the Pennsylvania Railroad, testifying before the Enginemen's Wage Arbitration Board of 1912, said:

> The basis of a company's credit is what it has over at the end of the year, after having made a reasonable return on the capital already invested. That is because when you want to borrow money, or sell your stock, those who want to buy or are going to buy want to know whether there is enough margin to carry you over and to pay returns on the money they are advancing until it can be made to pay itself.
>
> Today we are spending a great deal of money on which we can never expect to get an adequate return, really any return, or if we do, it is so small or so indefinite that it is very hard to describe just what it will be. All of that is naturally known, and the investor must be assured that he is going to get a return on what he invests.

The standard railroads of America have been enabled to develop and expand without State guar-

anty of interest charges and without excessive capital obligations largely because of this so-called "American financiering policy" which aims to maintain the company's credit by developing the property from surplus earnings and not by increased capitalization. It may be safely said that only because of the enormous expenditures made from current income for new railroad construction and for additions and betterments the leading railroad systems have succeeded in maintaining or increasing the return to shareholders.

The superiority of the American system is manifest when contrasted with the methods of British railroads. The latter charge revenue with only the amount necessary to keep the line at its original efficiency; practically all additions to rolling stock and all kinds of extensions and betterments are charged to capital. After that, the profits are divided among security holders. This policy has resulted in enormous increase of British railroad capitalization and a consequent diminution in market value of their shares.[1]

THE PROFIT & LOSS ACCOUNT

The foregoing discussion of the principal items in the *Income Account* gives occasion for only a brief description of the *Profit & Loss Account*. In the

[1] See W. M. Acworth, "Railroad Accounting in America vs. England," *North American Review*, March, 1910; also a paper by the author, "Control of Railroad Accounts in Leading European Countries," *Quarterly Journal of Economics*, May, 1910.

language of the Interstate Commerce Commission:

> The Profit and Loss Account summarizes the changes in the corporate surplus or deficit during a given fiscal period resulting from the operations and business transactions during that period as well as changes effected by appropriations of surplus made at the option of the company, by accounting adjustments not properly attributable to the period, or by miscellaneous losses or gains not provided for elsewhere.
>
> The Profit and Loss Account is the connecting link between the Income Account and the General Balance Sheet, and the total balance in the account should therefore be shown in the General Balance Sheet Statement.[1]

The necessity of a permanent *Profit & Loss Account* is due to conditions which prevent the definite allocation or distribution of all gains and losses to a specific period. The account, however, is not intended to cover every item of income or expense which overlaps from one year to another and which cannot be fully determined in each period. It is intended primarily for extraordinary and seriously delayed transactions which at the time they are finally entered on the books have no relation to current business.

Probably no better illustration of the use of the *Profit & Loss Account* is afforded than that in connection with the abandonment of property. It was pointed out on page 183 that in accordance with Interstate Commerce Commission regulations the value of property abandoned *incidentally* in the making of additions and betterments is a charge against revenues and not against accumulated surplus. Under this ruling no part of the losses from prop-

[1] "Form of the Income and Profit and Loss Statement," First Issue, p. 9.

erty abandoned because of the construction of new sections of roadbed or track, or of new buildings, would be entered in the *Profit & Loss Account.* However, in the case of property abandoned *without replacement of any kind,* the loss is entered directly in the *Profit & Loss Account.* Though the net result to the railroad company is the same whichever method is used, the effect on the market value of securities is vastly more pronounced when the loss is deducted from current income instead of from the *Profit & Loss Surplus.* The impairment of net income in any one year may necessitate a temporary reduction in the dividend rate which is an influential factor of market value.

Extraordinary payments other than losses through abandonment of property are entered in the *Profit & Loss Account.* Thus, it is permissible for a railroad company, at its option, to charge all or a part of discount on funded debt to *Profit & Loss,* thereby extinguishing or reducing this charge against annual income during the period of the indebtedness.[1] The cost of extensions, improvements and betterments may likewise be deducted directly from *Profit & Loss.* The amounts thus deducted, however, become a part of the "*Appropriated Surplus,*" and the transaction is merely a bookkeeping entry. A railroad company's accumulated surplus representing *net proprietorship,* therefore, is separated into two parts: the "*Appropriated*" *Surplus* which cannot be arbitrarily withdrawn or reduced, and the "*Profit*

[1] See pp. 180–181.

& Loss" Surplus, which is the reservoir for meeting extraordinary losses and dividends, and to which current surplus profits and extraordinary gains are added.

A railroad has the option of charging any dividends to *Profit & Loss* or to current income. The Louisville & Nashville, the Chesapeake & Ohio, the Lehigh Valley and a number of other railroads regularly pay dividends from *Profit & Loss Surplus* instead of charging them in the *Income Account.* It would seem that under ordinary circumstances dividend deductions made from one account would preclude deductions for like purposes from the other. This, however, is not the case. The Chicago, Milwaukee & St. Paul Railroad's first semi-annual dividend for the fiscal year 1911 on both the Preferred and Common Stock was entered in the *Income Account,* whereas, the second semi-annual payments appear as deductions in the *Profit & Loss Account.* This may have been due to the fact that the full amount of the dividends consumed the total *Net Corporate Income* available for this purpose, and in order to avoid showing a "deficit" the second semi-annual disbursements were charged against the accumulated surplus. Transactions of this kind, rendered necessary by accounting exigencies, are apt to mislead the layman desirous of knowing the actual financial results of railroad operations.

As illustrating items in a railroad *Profit & Loss Account,* the following example from an annual report of the Chicago & North Western Railway Company is presented:

PROFIT AND LOSS ACCOUNT, JUNE 30, 1911

DR.		CR.	
Depreciation accrued prior to July 1, 1907, on equipment retired or changed from one class to another during the current fiscal year......	$1,282,296.73	Balance, June 30, 1910...........	$32,178,932.10
		Balance Income for Year ending June 30, 1911, brought forward from Income Account . .	1,703,485.01
		Balance from operations of Land Properties for year ending June 30, 1911	522,145.69
Discount on C. & N. W. Ry. 4% General Mortgage Gold Bonds of 1987 sold during the year....	825,000.00	Amount transferred from "Appropriated Surplus" on account of the retirement of Madison Extension and Menominee Extension First Mortgage Sinking Fund Bonds	806,323.05
Net loss on property sold or abandoned and not replaced	53,854.24	Balance of accounts written off the books, etc......	16,728.34
Balance Credit, June 30, 1911, carried to Balance Sheet	33,066,463.22		
	$35,227,614.19		$35,227,614.19

The first item among the deductions (left-hand side) calls for explanation. It represents losses to the company due to the depreciation on equipment prior to July 1, 1907, This depreciation had not been charged against income during the time the depreciation *accrued*. A valuation must be placed by the railroad on equipment retired from service or reclassified so that such changes can be entered on the books of account. In making these revaluations consideration is given to the losses due to use, *i. e.*, depreciation. Now, it is evident that all of this loss did not occur since July, 1907, when the Interstate Commerce Commission's depreciation accounts went into effect. Consequently, to charge the depreciation of years prior to July, 1907, to the income of later years is unfair and improper. The money value of the depreciation estimated to have accrued in the earlier years is therefore deducted from the *Profit & Loss* balance. Under modern bookkeeping methods this is the only proper way of accounting for losses that have occurred in past periods, but had not been entered on the books.

The deduction of discount on bonds of the company sold during the year indicates that the management prefers to wipe out expenses of this character instead of charging the income of each year equally during the time the bonds are outstanding. The charging of the *Profit & Loss Account* with the net loss on property sold or abandoned and not replaced is in accord with the regulations of the Interstate Commerce Commission.

The items entering into the *Profit & Loss Account* as additions to the *credit balance* which has been carried over from the preceding period include, first of all, the surplus income for the year transferred from the *Income Account.* The second item is the net income from the sale and operation of the company's "land grant" lands. The transactions in connection with these lands are entirely apart from railroad operations. Consequently, in accord with Interstate Commerce regulations, the profit may be entered in the *Profit & Loss Account.* The fourth item represents merely a bookkeeping transaction arising from the redemption of bonds. In this case a part of the surplus of the Company previously appropriated is again made available for adjustments of loss or for distribution in dividends. The last credit item requires no comment, probably representing accounts payable for which demand has not been made or is not expected to be made.

Summing up the deductions and additions to the account, the Company shows a net gain in *Profit & Loss* for the year of $887,531.12 and the total balance $33,066,463.22 is carried forward to the *General Balance Sheet.*

CHAPTER XI

THE GENERAL BALANCE SHEET

In studying railroad financial progress, the *Balance Sheet* as a rule is hurriedly passed over, not because it is less important than the *Income Account*, but because it is less readily understood. The *General Balance Sheet*, if properly compiled, purports to show as nearly correctly as possible a company's financial condition as determined or influenced by operating results and by fiscal changes since its corporate organization. It is thus the representation of cumulative effects, whereas, the *Income Account* is merely an exhibit of the results of a year or even shorter period. The *General Balance Sheet*, therefore, when properly interpreted, furnishes a better indication of financial status and of investment value than current earnings, which frequently are the result of temporary conditions.

General Survey of the Balance Sheet. The Interstate Commerce Commission's prescribed Condensed General Balance Sheet is as shown opposite p. 240. The form of the *General Balance Sheet* here given does not greatly differ from the form prevailing previous to the inauguration of uniform railroad accounts. The items are now stated in greater detail and, in some cases, the classification is slightly

different than formerly. The Interstate Commerce Commission endeavors, as far as possible, to have railroad property separated from the other items in the *General Balance Sheet.* This is in line with the policy of exhibiting railroad operations distinct from other activities. The purpose, however, cannot be fully accomplished until there is a complete inventory of each company's assets. Acknowledgment of this fact is indicated in the prescribed *General Balance Sheet,* in which all physical property is included under one general item "Property Investment."

The assets in the *General Balance Sheet* are placed under six groups: (1) *Road & Equipment;* (2) *Securities;* (3) *Other Investments;* (4) *Working Assets;* (5) *Accrued Income;* and (6) *Deferred Debit Items.* The first three are classed as "Property Investment" and are technically known as "fixed" assets because they are permanent factors of the enterprise. The other assets are called "current" or "liquid" assets because the identity of each unit is constantly converted and interchanged by the operations of the company. The last general group. *Deferred Debit Items,* represents chiefly prepayments or claims not yet due. These include prepaid rent, insurance and taxes, accrued interest, and funds held apart from the general assets of the company for reserve and sinking fund purposes.

The two main items under *Road & Equipment,* it will be noticed, are distinguished as to time of acquisition rather than as to class of property. This

arises from the fact that previous to the Interstate Commerce Commission's accounting regulations, no compulsory distinction in the accounts was made with reference to separate value of road and of equipment. In most cases these had been agglomerated in a "*Cost-of-Road Account.*" Since 1907, however, new acquisitions of physical property must be classified in accordance with the official regulations under (a) *Road*, (b) *Equipment* and (c) *General Expenditures.* Thus we see that in the *General Balance Sheet* here selected for illustration the investment in road since 1907 amounts to $10,144,118 and the investment in equipment, $10,727,385. The previous investment in physical property is stated at $271,099,017.

The requirement of equipment depreciation accounts on the books of the railroads creates a new item, "*Reserve for Accrued Depreciation,*" which appears in the *General Balance Sheet* as a deduction from "*Road and Equipment.*" This reserve represents the unextinguished charge against income since 1907 to cover accrued depreciation of equipment in the service of the company.

The second main item under *Property Investment, viz.:* "*Securities Owned*" represents the company's own unsold funded indebtedness and the security holdings in other railroads or kindred undertakings. All these are classified into three categories—(1) *Securities of Proprietary, Affiliated and Controlled Companies—Pledged*, (2) *Securities Issued or Assumed—Pledged*, and (3) *Securities of Proprietary, Affiliated*

and Controlled Companies—Unpledged. The basis of this classification is discussed on page 251.

The item "*Investments*" in the *General Balance Sheet* is sub-divided into (1) *Advances to Proprietary Affiliated and Controlled lines for Construction, Equipment and Betterment*, and (2) *Miscellaneous Investments.* Under the first are included only advances made for capital expenditure. Temporary and current loans are under "*Deferred Debit Items.*" *Miscellaneous Investments* comprise the cost of securities of concerns other than transportation or kindred enterprises. They are the equities in the "extraneous undertakings" and "outside properties" of the railroad companies.

The *Working Assets* are the available cash or cash equivalents together with the materials needed in current operations. As already mentioned, these items undergo constant change, being either expended or consumed, or converted into the fixed assets.

The classification of the liabilities corresponds very closely to that of assets. The *Capital Stock* and the *Bonded Indebtedness* are set opposite the *Property Investment*, and the *Working Liabilities* are an offset to the *Working Assets*. The *Accrued Liabilities not Due* together with the *Deferred Credit Items* are accounts of the same nature as the *Deferred Debit Items*. The *Surplus* accounts (which include the *Profit & Loss* balance), however, have no distinctive countervailing item among assets. In fact, the *Surplus* is merely an item balancing

assets and liabilities. It is placed on the asset side of the *General Balance Sheet* whenever all the other liabilities exceed the total assets. In this event the *net proprietorship* (see page 170) represented by the *Surplus* becomes a negative quantity, *i. e.*, a "*deficit.*"

The *Capital Stock* and the *Bonded and Secured Debt* constitute railroad capitalization. Herein is included all funded debt which has a maturity period of not less than a year. Thus, as pointed out in Chapter II, temporary notes which are issued to mature in one or more years are a part of railroad capitalization.

Capital Stock is classified in the *General Balance Sheet* as "*Common,*" "*Preferred*" and "*Debenture Stock.*" The *Funded Debt* is also classified, six separate categories having been established by the Interstate Commerce Commission.

Under *Working Liabilities* are included items representing debts and obligations of a maturity of less than one year. The *Accrued Liabilities not Due* are items which have already been charged against income but which have not been actually disbursed. The *Deferred Credit Items* cover the various operating reserves and special trust funds (except the *Equipment Depreciation Reserve* which is deducted directly from the Property Investment). These reserves have been accumulated through charges to *Operating Expenses.* They are, therefore, separate and distinct from sinking funds, and from other reserves that are deductions from *Net Corporate Income* or

from *Profit & Loss*. These are a part of the surplus which as previously mentioned, is divided into two parts: (1) the *Appropriated Surplus*, representing appropriations or reserves maintained for some definite purpose, and (2) the *Profit & Loss* balance, which is the *free surplus* held at the discretion of the company's directors.

Before passing to a detailed analysis of the items in the *General Balance Sheet*, reference should be made to "contingent liabilities," As pointed out on page 228, many of the leading railroad companies guarantee by endorsement the obligations of subsidiaries. No real indebtedness is thus assumed unless default is made by the issuing corporation. The contingent liability, therefore, is not taken on the books of the parent company and finds no place in the *General Balance Sheet*. However, a foot-note attached to each company's financial statements setting forth the contingent liabilities would assist the purposes of publicity.

Property Accounts. These in the *Balance Sheet* are intended to be a statement of the actual investment in the property. The failure to meet this purpose may arise from various causes. Reference has already been made to the practice of a number of American companies of charging the cost of a large part of improvements and betterments directly to *Operating Expenses*. Such charges increase the investment but leave no permanent record of the property value thereby created. Consequently, the increase is not shown in the *General Balance*

Sheet. On the other hand, many financially weak roads neglect to charge losses in actual value of property, whether through operations, through reconstruction or through obsolescence, against earnings. The actual investment is thus correspondingly reduced without a bookkeeping record thereof.

With reference to some of the standard railroads such as the Pennsylvania and the Illinois Central, it is sometimes possible by an analysis of the annual reports over a series of years to determine, approximately, to what extent permanent improvements were made from current earnings. No such approximation can be made, however, in the case of railroad companies failing to enter losses due to abandonment of property and to obsolesence. A railroad, let us say, constructed a line over a mountain because it was more economical at the outset to haul the traffic over steep grades than to undergo the heavy cost of cutting a tunnel. In the course of time, because of the growth of traffic, the business can no longer be handled over the mountain line, and a tunnel is constructed. The entire cost of this tunnel is added to the account, *Cost of Road & Equipment,* without any deduction or allowance for the cost of the original mountain section which is abandoned. According to correct accounting theory the cost of the displaced line—(assuming that it was known several years in advance that it would be displaced)—should have been gradually effaced from the company's books by deductions from *Net Income* or from *Profit & Loss.* In the absence of

official regulation prior to 1908, no railroad was required to follow this practice, though they are now governed by strict regulations in these matters.

Aside from errors in accounting principles, the property accounts frequently fail to correctly represent actual investment because of "stock watering." This phrase is too familiar to require detailed explanation. Railroad reorganizations; the purchase by one company of the property of another through exchange of securities; the issue of stock bonuses and the like, all have affected the book valuation of railroad property without changing correspondingly the "actual" money cost of the investment. The resulting difficulties in measuring investment or value led Congress early in 1913 to pass a law authorizing governmental valuation of railroad physical property. Whether this will accomplish the desired effect is a matter of much controversy and does not call for comment in this work.

The important problem in the study of property investment is the measurement of the "*Cost of Road and Equipment*" by some satisfactory standard unit. Cost *per mile of single track owned* is frequently employed as the most acceptable unit. Great caution, however, must be exercised in using this standard. Differences not only in the physical qualities of the railroad property itself but also in the cost of construction (due to topographical and geological conditions) may render comparisons on the *per mile* basis absolutely worthless and even misleading. No

two miles of railroad cost exactly the same. Some cost less than $18,000, others cost $500,000 or more. Moreover, miles of yard tracks in some large terminals where right of way is expensive cost more than the average cost of the main track.

A further objection to the *per mile* valuation is that "Cost of Road & Equipment" as between different railroad companies (or in the same company at different periods of time) does not constitute the same items or identical items similarly apportioned. Some of the strong railroad companies own their own terminals and dock facilities instead of incorporating them separately or sharing the ownership with other roads. The inclusion of these terminals under "*Property Investment*", because of their extremely high cost relative to other property, makes a railroad appear to have a much larger *per mile* investment in physical property than if these facilities were leased or operated separately. The absence of itemization and of detailed classification of railroad property in the *General Balance Sheet* is thus a deterrent to correct analysis of relative property cost.

Another difficulty of the same nature arises from the intercorporate relations of railroad companies whereby a large part of railroad mileage is not owned and operated in fee simple, but through leasehold and stock ownership. The value of the equity in the controlled properties is not always accurately represented under "*Securities of Proprietary, Affiliated or Controlled Companies.*" Yet in many cases

the parent company combines the mileage of subsidiaries with its own mileage, and when a *General Balance Sheet* represents a "system report" the property accounts of subsidiaries are rightly incorporated with the parent company's own property held in fee simple.

Examples of statistical complexities due to railroad intercorporate relations are to be found in the official statements submitted to the Interstate Commerce Commission during the freight rate controversy of 1910. Thus, the "*Cost of Road & Equipment*" as submitted by the Baltimore & Ohio Railroad for the years 1908 to 1910, inclusive, were:

Miles Owned—All Tracks [1]	*1908* *7,358.43*	*1909* *7,344.16*	*1910* *8,215.19*
Cost of Road and Equipment..	$396,018,427	$405,984,542	$281,153,035
—per mile of line owned	100,337	102,447	64,881
—per mile owned—all tracks	52,818	55,280	34,224

It will be noticed that although the miles owned in 1910 were 871 miles greater than 1909, the cost of road declined from $405,984,542 to $281,153,035, representing a decrease *per mile of track owned* from $55,280 to $34,224. The annual report of the company for 1910 offered no explanation of this startling discrepancy. Inquiry revealed the cause as a change in the "system report" of the company. Previous to 1910 the property accounts of the Baltimore & Ohio's proprietary companies (companies owned en-

[1] Includes mileage of proprietary companies.

tirely but operated under separate corporate organizations) were incorporated in the parent company's item "*Cost of Road & Equipment.*" In 1910, however, they were excluded from this item and placed under "*Securities Owned.*" Thus, to arrive at actual cost of the Baltimore & Ohio property, on which to base operating revenues of 1910, about $185,000,000 book value of "*Securities Owned*" should be added to the $281,000,000 representing the reported book value of "*Cost of Road & Equipment.*" This makes the actual cost of road $466,-236,743 on June 30, 1910, which compares properly with the figures in the 1909 statement.[1]

Securities Owned: The intricate corporate interrelationships of American railroad companies demand a careful analysis of the items included under "*Securities Owned.*" As has been already pointed out, the Interstate Commerce Commission distinguishes three classes of securities owned; (1) *those of subsidiary companies—pledged;* (2) *those issued directly or assumed by the company and also pledged;* and (3) *the securities of subsidiary companies held unpledged.*

(1) Under the first is included the book value of pledged securities of proprietary, affiliated and controlled companies "*whose property is used by or forms*

[1] A similar apparent discrepancy was produced when the Union Pacific in 1901 merged the accounts of the Oregon Short Line and the Oregon Railroad and Navigation Company with its own. In this case an increase of approximately $83,000,000 in the "Cost of Road and Equipment" item was caused in order to properly readjust the accounts.

a part of the railroad system of the respondent company." These securities have been pledged as collateral for some part of the parent company's funded debt or other obligations. They may include stocks and bonds of controlled railroad lines, of terminal, bridge and ferry companies or of other concerns forming a link in a general transportation system. Since these securities are pledged under a deed of trust they are not readily convertible into cash or other assets, and cannot be used for purposes of obtaining further credit.

(2) Under the second class are included the par or face value of the respondent company's own funded obligations or the obligations it has legally assumed as a direct liability,[1] which are pledged as collateral for other indebtedness. Under the ruling of the Interstate Commerce Commission, both the par value of these pledged "treasury" securities and the new obligations for which they are pledged as security appear as liabilities in the *General Balance Sheet.* There is thus an artificial inflation of both assets and liabilities.

(3) As to the third class, *Securities of Controlled Companies—Unpledged,* though these are technically "free assets" since no deed of trust restricts their sale, for all practical purposes they are as "fixed" as the railroad's own physical property. Accordingly these securities are not deemed "marketable." They may be used, however, for purposes of obtain-

[1] Under this class are not included securities which have been endorsed or the payment of which has been guaranteed.

ing additional credit and therefore may form the basis of new capital obligations.

Ordinarily a corporation is said to be administered and controlled by another company when the latter owns 51 per cent. of the class or classes of capital stock in which the voting power and the corporate management is lodged. This constitutes corporate control. However, among railroad companies, particularly when control is held jointly with other companies, this majority proportion of stock ownership is not required. For, although the relative equity in a subsidiary may represent only a minority of the capital stock having voting power, if this minority forms a part of a "joint control" with other lines or is held for the purpose of obtaining use of additional facilities or for promoting exchange of traffic, the equity is to all intents and purposes a "fixed" asset.

There is probably no better example of "joint control" for the purpose of obtaining additional facilities than that of the Terminal Railway Association of St. Louis, declared a violation of the Sherman Anti-Trust Law by the United States Supreme Court in April, 1912. Nine railroads owned each a proportionate share of the capital stock of this terminal company. One of the regulations of the terminal company was a requirement that no privileges should be granted to any new railroad as long as any one of the nine controlling roads should object. This constituted a practical monopoly of the facilities, inasmuch as it is out of the question for any new

terminal to be constructed or access gained to St. Louis, owing to the peculiar topography of the place. In this instance, it is readily seen that, although one-ninth ownership did not constitute administrative control by any individual company, nevertheless, it gave each company a valuable right to use a terminal facility. Consequently, the stock of the St. Louis Terminal Railway Association represents, in each case, a part of the property investment of the holding companies.

Miscellaneous Investments: With some classes of American railroads, business operations other than transportation have been a leading factor in their financial progress. The ownership of large coal mines, of steel mills and of oil and ore lands are but a few of the large railroad undertakings. The Philadelphia & Reading Railroad was forced to submit to at least three reorganizations in order to scale down the heavy funded obligations caused by excessive investments in unproductive coal lands. On the other hand, the Northern Pacific, because of a dividend received from the Northwestern Improvement Company—one of its "mysterious" subsidiary concerns—was enabled in 1908 to pay an extra cash distribution of more than 11 per cent. to its shareholders. Similarly, the Great Northern Railroad, in order to divest itself of the swollen value in its ore properties, in November, 1906, created the Great Northern Ore Trust, distributing to each stockholder a proportionate share of participation certificates. Other instances of bankruptcy or of

bonuses from the ownership of "outside" enterprises might be given. A difficult problem is the ascertainment of the real worth and profitableness of these undertakings. Notwithstanding publicity of railroad affairs, this information is not generally obtainable from the annual reports of the companies or from the official data of the Interstate Commerce Commission. Certainly the values at which these investments are carried in the *General Balance Sheet* do not necessarily correspond in any way with their actual worth. The profit with which the railroad company credits itself as coming from these sources does not necessarily coincide with the actual earnings of the properties. There is no law which provides for the publicity of the accounts of the non-transportation corporations controlled by railroad companies. It is discretionary with the railroad's directors whether the facts and conditions in each case shall be made known. The occasional suspicion of "hidden assets," nurses from time to time a speculative interest in certain railroad shares. Thus, it seems very plausible that in view of the Northern Pacific's "melon" to stockholders in November, 1908, from the Northwestern Improvement Company, another of the same kind is likely to come. The Balance Sheet of the Northern Pacific, however, reveals the book value (which is evidently the original cost) of the Northwestern Improvement Company's stock as $7,000,000 (the par value). But a concern which can pay a cash dividend of $17,453,000 is presumably of greater worth. The *General Balance*

Sheet does not necessarily reflect the real worth. It contains merely the book values of the assets.

The Canadian Pacific Railway is another instance where great importance is attached to "hidden" assets in outside properties. It is contended that the company's vast holdings in farm and townsite lands, when analyzed, show an amazing accumulation of wealth from which the shareholders will profit in the future. In appraising the value of Canadian Pacific's "hidden assets" the fact is pointed out that the company is the largest individual landowner on the face of the globe. Moreover, there is probably no landowner in the world whose property is mounting so rapidly in value as is the property of the Canadian Pacific Railway.

There is generally no way of telling whether the profits received from miscellaneous investments as shown in the *Income Account* or *Profit & Loss* statements of the railroads represent in each case, even approximately, the amounts actually earned. A general feeling is prevalent in some quarters that the directors of the Reading Company have been persistently understating the earnings of its coal properties. Yet, even after several reorganizations, the accounts of the Reading Coal and Iron Company have shown a very small return on the investment. The existence of such uncertainties in large organizations whose affairs are so closely observed makes it evident that the public judgment should be based only on certified and readily confirmed facts or conditions and not on suppositions and speculative rumors.

The movement toward the acquisition and operation of non-transportation enterprises by railroad companies has been somewhat curtailed by the so-called Commodities Clause of the Interstate Commerce Act, enacted June 29th, 1906. This clause prohibits a railroad company from transporting over its own lines commodities produced by it either directly or through control of separately organized corporations, unless such commodities are for its own use. As a result of this prohibition, the Delaware, Lackawanna & Western and the Lehigh Valley Railroad each organized "coal sales companies" to purchase the product of their respective coal mines. Litigation is still pending in the case of some other coal roads.

Another element besides the direct profits received from outside enterprises enters into the estimation of their value. Most of the acquisitions of this nature have been made largely or entirely with the view of creating or maintaining railroad traffic. Thus, Mr. F. B. Gowen, who as President of the Philadelphia & Reading Railroad during the period 1869–1875 acquired the company's vast coal lands, stated that his purpose was first to forestall the building of rival coal roads and, secondly, to use the coal traffic as a means of providing a west bound tonnage by the aid of which the Reading could develop into a "trunk line" and compete with the Erie and the New York Central for "through" business. Accordingly, the aim was not to obtain profit directly from coal mine operations. Similarly,

the Pennsylvania Railroad's ownership of the Cambria Steel Company is apparently not with a view to operating the plant for a profit, but rather as a curb to the price exactions of steel companies for materials. The intrinsic value of these investments are not to be gauged exclusively by the amount of their cash dividends.

Working Assets and Liabilities. The relative amount and kind of the free "working" or "liquid" assets (*i. e.*, cash or cash substitutes) of a railroad company require in many cases closer observation and analysis than the property accounts. It is with these assets that the railroad meets current business needs and pays current expenses and obligations. If they do not suffice for this purpose the company must either borrow additional funds or acknowledge insolvency. A receivership might result, therefore, even when the value of the "fixed" assets are in excess of its actual liabilities, or when the net earnings are sufficient to cover interest on funded obligations. Liquid assets are a part of the necessary working machinery of a railroad company. When the amount on hand is depleted, it must be replenished by borrowing or by reduction of wages or of dividends. Wage cutting may lead to costly labor difficulties. Dividend cutting may impair the company's credit, rendering impossible the securing of new capital required for improvements and extensions. As a rule, railroad transactions are conducted on a "cash basis," (passengers and shippers generally paying in advance or immediately after the services

are rendered). Need for working capital arises mainly from the expenditures for upkeep, improvements and extensions and not generally from transportation operations.

Among the *Working Assets* are included the inventories, (*i. e.*, materials and supplies) and the marketable treasury securities. The items requiring first consideration, however, are the *Cash* and the *Accounts Receivable.* The size of the cash balance together with other items readily convertible into cash, when taken in relation to current requirements and to the amount of construction work on hand, may indicate roughly whether or not additional financing through sale of securities is forthcoming. The borrowing of additional funds has a direct influence (in some instances favorable, in others unfavorable) on the market value of securities already outstanding. The cash position of a railroad system, therefore, is closely observed by railroad financiers.

A common method of determining the relative adequacy of the "*working assets*" is by contrasting these items with the corresponding "*working liabilities*" on the opposite side of the *General Balance Sheet.* This may be done in the following manner:

Working Assets:	
Cash Balances	$8,000,000
Accounts and Balances Receivable	13,000,000
Materials and Supplies	6,500,000
Total Working Assets	$27,500,000
(Deduct) *Working Liabilities:*	10,500,000
Net Working Assets	$17,000,000

The result shown by the above computation has no significance unless compared with that of the years immediately preceding or contrasted with the cash position of other railroad companies. All changes and disparities in gross earnings, operating conditions and immediate capital requirements are to be taken into consideration. Tests of this character, though not final, frequently furnish a clue to future financial developments.

Surplus. We come now to a consideration of the *Surplus* items in the *General Balance Sheet.* These, in the aggregate, form a foundation for credit. In other words, they constitute a sort of guarantee fund against disaster. At the same time, they are a reserve out of which improvements and extensions may be made.

Attention has already been directed to the American railroad policy of improving the physical property by appropriations from current income. This has been accomplished in two ways. In the first place, many improvements and betterments have been charged to *Operating Expenses* as a part of maintenance. Secondly, surplus earnings, instead of being distributed *in toto* to shareholders, have been partly applied to improvements and extensions or to the general resources of the corporation. In the decade ended June 30, 1910, the railroads, notwithstanding heavier maintenance outlays and increased fixed charges, accumulated an aggregate surplus of $606,536,556. This, according to the Interstate Commerce Commission's computation,

represents an increase of 312 per cent. of the surplus of 1899, whereas, the mileage had increased only 36 per cent.[1]

This accumulated *Surplus* of the American railroads does not constitute cash or its equivalent. It cannot be physically distributed as a bonus. Most of it is expended for additional property and facilities. Accordingly, even with a large *Surplus* in the *General Balance Sheet*, a company may be financially embarrassed because of insufficient cash assets to meet current obligations. The recourse under these circumstances is to borrow cash on the basis of the accumulated *Surplus*.

The *Surplus* accounts of the railroads, do not represent in all cases merely the aggregate net earnings which the directors have chosen not to distribute among shareholders. As pointed out on page 244, the term "Surplus," as used in accounting, means simply the excess of the book value of the assets over the liabilities. It is the item which makes an equation of the two sides of the *General Balance Sheet*. Hence, the *Surplus*, of which the *Profit & Loss Account* forms the "free" or unappropriated part, is the result of adjustments made from year to year on both the *debit* and *credit* sides. Some of these adjustments have no reference whatever to current income. Thus, profits from the sale of assets and from other extraneous sources are regularly credited to *Profit & Loss*. The item may also include premi-

[1] See Report of the Commission, "In re Advances in Rates," etc. No. 3500. p. 5378.

ums realized from the sale of new stock or bonds. We had an illustration of this in 1909 when the "St. Paul" directors credited to the *Surplus*, through the *Profit & Loss Account*, $1,532,336 received as premiums on stock sold back in 1901 and 1902. Similarly, in 1903 the Pennsylvania Railroad sold $75,094,750 stock at 120. The premium received represented over $15,000,000. The New York Central, also, in 1902, disposed of stock amounting to $17,250,000 which was put out at 125. In the same way, the New York, New Haven & Hartford disposed of $44,643,800 of stock at 125 and back in 1903–04 put out new shares as high as 175.[1]

Furthermore, several leading companies have created some large issues of "convertible" bonds. The holders frequently exchange these bonds for stock on such terms that the par value of the stock given in exchange makes a very much smaller total than the par value of the bonds taken up. The bookkeeping effect of such an operation is to diminish the amount of the liabilities as represented by the original par value of the bonds, and to swell the sum total of the *Profit & Loss* balance to the extent of the difference. The Pennsylvania created $50,000,000 of convertible 3½s in 1902 and made another issue of the same kind for $100,000,000 in 1905. The first issue is convertible into stock on the basis of 140 for the shares and the second on the basis of 150; $52,942,500 of the bonds had been converted up to January 1, 1911, and were represented on the books

[1] "The Commercial and Financial Chronicle," vol. 92, p. 920.

by only $37,189,167 of stock. Thus, there was a "paper" profit of, approximately, $15,000,000, which had no connection whatever with surplus earnings. To assume, therefore, that growth of the *Surplus* account represents nothing but accumulated earnings from operation is technically incorrect.

On the other hand, the amount of the *Surplus* is no accurate indication of the actual additions in value to the railroad property beyond the investment represented by the par of the outstanding capital securities. Among some companies, the practice has prevailed of reducing *Surplus* from time to time for the purpose of "writing off" assets not essentially productive of income, or to offset possible obsolescence. Thus, the Pennsylvania Railroad deducted more than one-half the cost of its New York terminal from accumulated *Surplus*. The Pennsylvania Company also in 1909 reduced *Surplus* by $10,000,000 on account of New York terminal construction though the property is not a part of its corporate assets.

Reference has already been made to the theory of railroad directors and financiers that a large *Surplus* must be accumulated and shown in the *Balance Sheet* in order to enhance railroad borrowing power. In other words, each addition to *Surplus* means greater underlying strength to the securities. This is only true, however, when additions represent actual increased value of assets. The theory assumes that all expenses properly chargeable to

operating revenues have been fully met and that reserves or appropriations for obsolescence, actual or probable displacement, and impairment in earning power of assets have been fully deducted. Otherwise, the *Surplus* is a "paper surplus."

A large surplus fosters stock speculation because of "melon-cutting." By this is meant a pro rata distribution to shareholders, usually in additional stock representing the whole or part of the accumulated *Surplus*. Thus, the Lehigh Valley Railroad, having built its property up largely through earnings and through very conservative financing, and having put the physical plant in excellent shape, was ready in 1912 to make an adjustment with its stockholders covering accumulated profits. The adjustment took the form of an extra dividend of 10 per cent. to be applied to the purchase of new shares of the company. While there was not the slightest concealment of Lehigh's gradual accumulation of profit and of the fact that at some time in the not distant future stockholders would receive stored up earnings which had previously been put back into the property, the fact that the "melon" was possible tended to give the Lehigh Valley shares a speculative character.

CHAPTER XII

RAILROAD CAPITALIZATION

Nature of Railroad Capitalization. In analyzing railroad capitalization a distinction must be made at the outset between *Capital* and *Capitalization.* Capital is the amount of actual money or equivalent value invested in the property. It comes both from the issue of securities and from surplus earnings. Capitalization, however, represents the nominal amount of securities outstanding, including funded indebtedness. Surplus earnings turned back into the property thus become a part of *capital,* but are not correspondingly represented in *capitalization.* Because of this distinction it is clearly evident that capitalization even when paid in entirely at face value does not represent the actual value of the property. It does not indicate what it is worth, the present or potential earning power, or the amount of the annual charges against income.

Among most American railroads, capitalization, (*i. e.,* the aggregate face value of stocks, bonds and other securities as stated in the *General Balance Sheet*), is as much due to arbitrary adjustments, necessitated by reorganizations, mergers and credit conditions, as to the receipt of cash paid in by the public. The regulation and control of railroad capi-

talization by governmental authorities is of relatively recent development in the United States. Until within the last two decades, railroad companies, with but few exceptions, were permitted to issue shares and securities whenever and in whatever manner they desired. The evils resulting from this liberal policy have been sufficiently magnified.[1] Unlike many industrial concerns, railroads, as a rule, have no sinking fund or other provisions for the amortization and extinguishment of capital liabilities. With but few exceptions, railroad stocks and bonds are issued as permanent and perpetual obligations. Bonds may mature on a fixed date, but, with few and unimportant exceptions, their refunding is necessary. Accordingly when injudicious financing or mismanagement require capitalization readjustment, it is accomplished only through receivership or reorganization.

The Pere Marquette Railroad furnishes an instance of the absence of proper capital amortization provisions. This railroad system was built originally through a timber region to afford transportation facilities to lumber camps and saw mills. The mileage, therefore, was extended wherever timber operations were large enough to furnish traffic. Bonds were sold with which to build these lines. After a time, however, the gradual exhaustion of timber supplies caused the lumber industry to move to other regions. The Pere Marquette was thus deprived of its principal business. Unable to de-

[1] See "Report of the Railroad Securities Commission," 1911.

velop new traffic, and compelled to pay interest charges on "dead" capital, the credit of the company became impaired. The failure to extinguish the portion of Pere Marquette's capitalization representing unproductive property prevented the company from acquiring new funds with which to improve its main lines. Handicapped by inadequate physical facilities, it cannot compete for through traffic with better equipped rivals. Moreover, it must continue to operate branch lines which, though originally profitable, have ceased to pay interest or even working expenses.

There are many other instances of incautious financing. The Toledo, St. Louis & Western Railroad, for example, issued bonds bearing a fixed interest charge in order to acquire a majority of the Chicago & Alton Railroad's capital stock. In 1907, at the time these securities were exchanged, the dividends on the Chicago & Alton's shares covered the interest charges on the Toledo St. Louis & Western bonds issued for their acquisition. The earnings on the Chicago & Alton's lines have since declined, however, resulting in discontinuance of dividends. Consequently, Toledo, St. Louis & Western, as a stockholder, has been deprived of income with which to pay interest charges on the collateral bonds. Its own margin of earnings above fixed charges were barely sufficient to withstand this loss and all its securities have depreciated in value.

The cases above cited are merely illustrative of the caution required in sanctioning issues of railroad

securities. Wise financial operations demand shrewd judgment and close scrutiny. It is for this reason that an accurate statement of the facts underlying security issues is a matter of public concern. Publicity is a requisite of modern investment finance. The capital outlay of railroads is enormous in proportion to the business done. This capital is spent once for all on the supposition that a certain minimum traffic will be moved at prescribed rates. These rates cannot be changed arbitrarily. As pointed out in Chapter III, though large traffic is necessary to make possible low rates, low rates are necessary to secure large traffic. A railroad, therefore, cannot readily recover loss in revenues by increasing charges. If an ordinary manufacturing or commercial business gets into financial difficulties because of unwieldy capitalization it may cease operations and be liquidated. Not so with a railroad. When a railroad company has exhausted its credit; is unable to raise money for new extensions, and cannot afford to improve facilities or reduce rates, it is a lasting financial burden. The enterprise, however, even though poorly paying, continues. There is, therefore, a clear public interest that railroad companies should be strong financially. In order that they may be strong, they must put aside from income the cost of actual replacements of property. They must also make ample provision for depreciation and for obsolescence of property. They must even provide for the contingency that portions of the property may cease to earn an investment return. Thus, the cost

of a branch built to develop coal lands, estimated to be worked out in twenty-five years, is properly a charge against earnings in this period. The line may continue to be operated even after the coal depletion has occurred, though it has ceased to earn interest on its cost or perhaps may not even earn direct operating expense.

Gross Capitalization and Net Capitalization. The principal stumbling block and the chief source of statistical errors in the measurement of railroad capitalization is the difficulty of clearly separating the portion of outstanding capital securities representing investment in a company's own railroad property from the portion covering the cost of investments in other companies or other enterprises. Railroad capitalization statistics distinguish "*net capitalization*" from "*gross capitalization.*" It is manifestly erroneous to measure the total capitalization of a modern railroad system on a *per mile* basis, when a large part of this capitalization arises from the acquisition of subsidiary railroads and of other enterprises not a part of its own mileage.

Because of both the complex business activities of American railroad companies and the incompleteness of accounting data, the separation of the "outside" investments represented in railroad capitalization is an extremely perplexing and difficult matter. In the first place, duplication must be avoided by deduction of inter-company holdings, *i. e.*, the interownership of securities of railroads comprising a system. When holdings have been acquired by

giving in exchange the purchasing company's own securities, *net capitalization* can be measured with some degree of accuracy by deducting the par value of the exchanged securities from the aggregate capitalization. Thus, the Atlantic Coast Line in 1902 acquired 51 per cent. of the Louisville & Nashville stock, issuing therefor $35,000,000 collateral trust bonds. The stock thus obtained, according to proper accounting methods, is given a book value equal to the par value of these bonds. Therefore, in determining the *net capitalization* of the Atlantic Coast Line, $35,000,000 in bonds is one of the items deducted from the company's aggregate of capital securities outstanding. Similarly, the $215,227,000 Chicago, Burlington & Quincy Collateral Trust 4 per cent. Bonds, issued in 1901 jointly by the Great Northern and the Northern Pacific railroads, forms no part of the *net capitalization* of either of these systems, though each, in its respective General Balance Sheet, places one-half of the entire issue among outstanding capital securities.

The deduction from "*gross capitalization*" of amounts representing ownership or equities in subsidiary companies and other enterprises is frequently not sufficient in order to determine the "*net capitalization.*" On page 252 it was pointed out that under the Interstate Commerce Commission's ruling, *securities issued or assumed* and pledged as collateral for outstanding securities, are to be included at par value both among assets and liabilities. A company, let us say, issues $10,000,000 of bonds. Instead of

offering them for sale, it deposits them with a trustee as collateral for a loan of $5,000,000 in the form of three-year notes. In this way $15,000,000 is added to the company's *gross capitalization*, because both the $10,000,000 bonds and the $5,000,000 three-year notes are placed among the outstanding capital securities. The actual addition to the company's resources, however, is but $5,000,000 represented by the cash received from three-year notes. Accordingly, the *net capitalization* has increased but $5,000,000. The $10,000,000 in par value of pledged, but unsold, securities represents merely a contingent liability. Only in the event of their sale either to satisfy the claims of the note holders or to realize additional capital funds do these securities actually become a part of *net capitalization.*

A further adjustment, in many cases, may be required to correctly ascertain *net capitalization.* The Interstate Commerce Commission's accounting regulations place unsold and unpledged company securities among the working assets in the *General Balance Sheet* and at the same time among the liabilities under *Capital Stock* or *Funded Debt.* It had formerly been the practice of many railroads to exclude their own unsold and unpledged securities from among assets, thereby excluding them from the capital liabilities. This is undoubtedly the proper method. These unsold securities are neither a resource nor an obligation. They are nothing more than paper. To include them as a part of railroad capitalization, is obviously an unwarranted inflation.

Net capitalization is commonly determined by deducting the items under "*Other Investments*" and also the par value of the companies own unsold securities from the capital liabilities in the *General Balance Sheet.* Applied to the Erie Railroad (June 30, 1911), the process is as follows:

Capital Stock Outstanding		$176,271,300
Bonded and Secured Debt		237,766,159
Gross Capitalization		$414,037,459
Less: Pledged Bonds included in above		14,160,000
		$399,877,459
(Deduct)		
Securities of other railroads, pledged	$66,382,850	
" " " " unpledged	1,045,211	
Other Investments	35,730,740	
Total Investments in Other Properties		$103,158,801
Net Capitalization		$296,718,658

Since the investments of railroads other than in their own corporate lines have not always been acquired directly or wholly from the proceeds of the sale or the exchange of securities, this method is obviously not applicable in every case. As was pointed out by the auditor of the Atchison system in a rate investigation; "Subsidiary companies that form a part of the regular company come to us and there is no way of telling how much of these companies is represented in our investment."[1] Many

[1] Evidence taken in the Proposed Advances of Freight Rates, Vol. X, p. 5,419., note.

of the large railroad systems have acquired outside enterprises with accumulated surplus funds. The Union Pacific furnishes a notable example. In a case of this kind, if the *Surplus* accounts of the holding company are added to the "gross capitalization" (assuming that these items represent their equivalent in money value) and from the sum is deducted the aggregate book value of "*Other Investments*," the resulting balance shows an approximately correct amount of *capital investment* in the railroad property. *It does not show, however, true net capitalization as measured by outstanding securities.* Thus, it is evident that, *with the exception of instances where the aggregate holdings in other corporations have been directly acquired by additional issues of securities, net capitalization under existing circumstances cannot be accurately measured from the General Balance Sheet.*

Capitalization and Leased Mileage. A further difficulty presents itself in the correct measurement of railroad capitalization. Erroneous computations of relative capitalization are frequently made because of neglect to consider leased and rented mileage. Theoretically, a rental charge is as much a payment for the use of capital as interest and dividends, and a railroad company at times has the choice of purchasing a company by selling securities, or operating it under a lease or guarantee. But the terms under which one railroad company operates the property or uses the facilities of another frequently require payments which are partly operating expenses and

partly rentals. The *Joint Facilities Accounts* instituted by the Interstate Commerce Commission were for the purpose of requiring the railroads to allocate payments and receipts arising out of the use of leased and joint facilities accordingly as such payments or receipts represent charges or credits to operating expenses and charges or credits for the use of capital. This provision with reference to many railroad leases is practically impossible of execution. Accordingly, a computation of capitalization so as to include the rented and leased property, cannot always be made by merely adding the outstanding capitalization of the leased line.

Another method of computing capitalization so as to include leased property is by capitalizing the rentals at a fixed rate. This assumes that the rentals are based on the current interest rate. Let us say that the rate is 5 per cent. Then, in order to capitalize the leased property, total rentals are divided by this current rate (5 per cent.), and the resulting quotient is multiplied by 100. Thus, a company paying an annual rental of $500,000 for leased lines should have $10,000,000 added to the capitalization represented by its own outstanding securities. This is, at best, an artificial adjustment. Lines which are built by railroad companies ostensibly as separate undertakings, but primarily for the purpose of operation through leasehold, are in many cases arbitrarily capitalized, whereas, leased lines which were previously independent competitors or which are operated as "feeders" may bring a rental either

greatly above or below that warranted by earnings or by the current interest rate.

Errors in Capitalization Statistics. An illustration of the perplexities in measuring capitalization was furnished during the Railroad Rate Investigation of 1910. In the course of the proceedings an attempt was made to compare the capitalization of the New York Central and the Pennsylvania Railroads. The tables compiled by the Interstate Commerce Commission made it appear that the New York Central was capitalized at $609,974 and the Pennsylvania at $332,492 per road-mile *owned.* The capitalization of neither, intelligently computed, is anything like the amounts assigned, not even the *gross capitalization* which includes the value of stocks and bonds owned by the respective companies. Both the New York Central and the Pennsylvania operate a considerable mileage of leased lines. The proportion of *owned* to the total operated mileage in these two systems in 1910 was as follows:

	New York Central	*Pennsylvania*
Miles of Road Owned.	805	2,123
Miles of Road Operated.	3,782	3,947

The *owned* mileage is practically all main line and terminals, on which the capitalization is necessarily high. Furthermore, each parent company has issued many millions of its own securities to furnish improvements, equipment and working cash for its entire system, owned and leased lines alike. The

capitalization *per mile* on which the Commission evidently relied was obtained by dividing the entire capitalization of each parent company by the miles of road *owned*, regardless of the fact that in each case parent company's capital obligations had been issued to supply the *leased* as well as the *owned* mileage with improvements and equipment; regardless also of the fact that each company's capitalization included obligations issued to acquire securities on an enormous mileage of connecting and competing lines.

Probably no better instance of errors in the use of *per mile* capitalization statistics can be pointed out than that contained in the *Opinion of the Interterstate Commerce Commission in the Western Rate Advance Case*, reported February 22, 1911. In the text of this decision the capitalization *per mile of road* of the Atchison system is stated as $84,000. This amount was obtained by dividing the total capitalization of the Atchison "System" by the mileage of the Atchison, Topeka & Santa Fé "Railroad" proper. It is, therefore, entirely misleading. The *system* mileage of the Atchison, on June 30, 1910, was 10,406 miles against 6,837 miles for the *company*. Based on system mileage, Atchison's capitalization is nearer $56,000 per mile than $84,000.[1]

Relative Interest Burden. In a correct estimate of capitalization it is of fundamental importance to

[1] Commissioner Lane, who wrote the opinion, tactfully acknowledged the error in a note added to a subsequent printing of the text. See "Evidence in the Proposed Advances in Freight Rates," Vol. X, p. 5,419, note.

clearly indicate the interest or dividend rate attached to railway security issues. If all railroad companies had the same proportion of each class and kind of securities outstanding, with correspondingly uniform interest and dividend rates, the measurement of relative capitalization on the basis of the par value of outstanding securities would be a simple matter. The absolute diversity in this respect, however, renders any study or comparison of railroad capitalization based on general compilations utterly nugatory and of mere academic interest. It requires very little analysis to demonstrate that a railroad having $60,000,000 of irredeemable preferred stock outstanding on which it pays the full dividend of 5 per cent. is no better off in respect to this item of capitalization than a company which has $75,000,000 of preferred stock on which it is required to pay only 4 per cent. Moreover, a railroad company which issues 5 per cent. 30-year bonds at par for $50,000,000 cash instead of issuing for the same cash sum $55,000,000 4 per cent. bonds of the same maturity may be justly accused of poor financial management. In the case of the 5 per cent. bonds the annual interest is $2,500,000. The charge on the 4 per cent. issue, including discount amortization, is less than $2,367,000.

The sale of railroad bonds or other obligations at less than the face value does not always indicate poor credit. Successful railroad financiers by closely studying investment conditions try to ascertain by what method capital may be acquired at the lowest

net cost. If this can be done by issuing at a discount bonds bearing a low interest rate it is good financial policy to offer these for sale instead of bonds bearing a higher rate. Investors are frequently satisfied with a smaller net return from a security to which a progressive enhancement of value is attached as the date of maturity approaches. The richest railroad companies, therefore, do not hesitate to sell 3½ per cent. and 4 per cent. bonds at a discount, though by issuing 4½ per cent. and 5 per cent. obligations they might obtain a premium. It is undoubtedly for the best interests of the corporation to sell securities at a rate which furnishes capital at the lowest cost. Of this important factor in sound financial policy, the capitalization statistics commonly used give no clue whatever. *It is the relative burden of the annual charge for the use of capital which is a better index to comparative capitalization than the nominal amount of outstanding securities.*

The Kansas City Southern, for example, has a capitalization *per mile of line owned* of about $119,000 which is higher than that of the St. Louis & Southwestern ($70,406) and the Missouri Kansas & Texas ($65,000), or any other railroad system in the same territory. However, of the $47,488,000 of Kansas City Southern funded debt, $30,000,000 consists of 3 per cent. first mortgage bonds. This large proportion of low interest-bearing debt combined with a large ratio of capital stock (51 per cent.) to total capitalization offsets considerably the disadvantage of high "*per mile*" capitalization. A comparison of

the fixed charges of Mississippi Valley railroad systems reveals that the burden of the Kansas City Southern in the fiscal year 1912 was but $2.159 *per mile operated,* against $2.761 borne by the St. Louis & Southwestern and $1.822 by the Missouri, Kansas & Texas. There is thus no abnormal capitalization burden on the Kansas City Southern. This is further indicated from the fact that its net income for several years has been sufficient to meet all interest charges and to permit, in addition, a maximum dividend distribution of 4 per cent. on $21,000,000 preferred stock. There has been, besides, a surplus available for general improvements and betterments.

Style of Capitalization. From an investment standpoint, the relative proportions of the various classes of securities is of far greater import than aggregate amount of capitalization. When a railroad system is earning a good return on all classes of its outstanding securities, it is largely a question of financial policy whether bonds or whether capital stock shall be sold to acquire additional capital. Companies that are unable to distribute dividends to shareholders, however, cannot readily issue new capital stock for the reason that people will not buy it, except at much below the face value. Accordingly, the only recourse of these companies in providing new capital through issue of securities is to sell obligations bearing a fixed interest charge. This enlarges the ratio of funded debt to the total capitalization. It also means an immutable burden on current earnings.

The consequence of inability to sell additional capital stock is clearly shown in the capitalization changes of the Erie Railroad as compared with those of the New York Central during the period 1901 to 1910, inclusive: [1]

	Erie		% Increase	New York Central		% Increase
	1901	*1910*		*1901*	*1910*	
Capital Stock	$176,271,300	$176,271,300	0.0	$116,000,000	$222,729,300	92.0
Funded Debt	169,862,815	225,997,748	33.2	193,772,941	268,592,427	38.5
Total	$346,134,115	$402,269,048	16.2	$308,772,941	$491,321,727	59.1

It will be noticed that during the last decade the outstanding stock of the Erie Railroad has remained stationary. The capital stock of the New York Central during the ten year period, however, almost doubled. Hence, the total increase in Erie's capitalization was in fixed interest-bearing obligations, whereas, less than 41 per cent. of New York Central's capitalization increase is thus represented. Because Erie's shares sell much below par, the company in order to obtain new capital is forced to increase its funded debt. This method of financing tends to burden a company with fixed interest charges.

There is another side to the shield, however. New financing, through the sale of capital stock on which

[1] Interstate Commerce Commission computations.

a relatively high dividend rate is paid, entails a heavier distribution from earnings than the same amount of interest-bearing obligations. In other words, the new capital is obtained at a higher cost than through sale of bonds. This has been the experience of the Chicago, Milwaukee, & St. Paul in the financing of its Pacific Coast extension. The New York Central, the Pennsylvania and the Illinois Central also have caused material disadvantage to shareholders that may come from acquiring new capital mainly through the sale of dividend paying capital stock. The financial disadvantage remains only as long as the prevailing dividend rate exceeds the net rate on new funded debt.

Trend of Railroad Capitalization. The record of railroad financing in the years 1900 to 1913 seems to indicate that bonded indebtedness is growing at a much faster rate than capital stock. The continuation of this trend, however, is not certain. The history of American railroad finance shows that first one and then the other of the two groups of securities excels in popularity. This is because of varying money market and investment conditions.

Increase of bonds rather than stock has been assisted at different times through the issue of convertible bonds. Thus, the Atchison has issued up to July 1, 1912, a total of $147,711,000 convertible bonds, of which $74,328,000 had been converted at the option of holders into common stock. The Norfolk & Western's financing by means of convertible bonds is another good illustration

of successful financing of this kind. At the end of the 1912 fiscal year $19,653,000 of a total issue of $25,569,000 of 4 per cent. bonds of the Norfolk & Western, dated June 1, 1907, were converted into stock, reducing the fixed charges by $786,120. It should be noted that this method of securing money cheaply and of reducing future fixed charges later is dependent on ability to earn a substantial dividend on capital stock. In other words, the net dividend return on the stock must be a good margin above the interest rate attached to the bond in order that conversion may take place.

A great deal of criticism has been recently directed against railroads selling additional capital stock to shareholders at less than prevailing market prices. In fact, this practice has been condemned as a species of stock "watering." A little reflection as to the exigencies of railroad finance and the factors determining market value should soon dispel these objections. In the first place it can be readily demonstrated that market prices of securities do not always form a reliable guide of value. *These are the prices usually of but limited amounts.* It is well known to experienced financiers that such prices cannot be maintained if a new issue is placed on the market. Secondly, the market price of railroad stock, to which there is attached the probability of a valuable "subscription" right is enhanced by reason of this condition. This enhancement in value begins and usually culminates before the subscription privilege has been received. When the profit of the subscription

right has been taken away, the market value of the shares correspondingly declines. Moreover, the announcement of an issue of new stock in appreciable amounts, when the old shares are selling at a slight margin above par, frequently causes a substantial decline in the market value of the outstanding shares. Railroad financial experience clearly demonstrates that a stock must sell considerably above par value when shareholders are willing to subscribe for new issues at a premium. The Pennsylvania Railroad Company, for instance, in 1903 offered \$75,000,000 new stock to its shareholders at 120 when the market price was above 140. The shareholders did not fully subscribe for the new stock so a syndicate of bankers were employed to underwrite the new shares. In the meantime, Pennsylvania shares actually fell to 110¾. In this case it is plain that the difference between the market price and the subscription price was not sufficient to give shareholders a profit. The new stock certainly could not have been sold immediately on the open market at 120. There were not enough buyers willing to pay this price.

In view of the influence of capitalization changes on railroad credit, the importance of studying railroad capital requirements cannot be magnified unduly. Because of extensions and improvements due to heavier traffic, to increasing competition and to public demands for efficient transportation service, additional capital expenditures of American railroads are continuous. Both Mr. E. H. Harriman

and Mr. J. J. Hill, two of the best informed railroad magnates of their time, repeatedly called attention to the heavy demands for funds necessary to enable the railroads to handle properly the constantly expanding traffic. A growing enterprise has constant need of money. The greater part of the new capital must be obtained from private investors. These, naturally, place their funds where the prospects for returns are fair and reasonably assured. They will put their money into railroads, therefore, only as long as the investment returns in railroad properties are as good and as well secured as in other enterprises. This competition of outside securities is an element in the cost of capital to the railroads. It must be successfully met if transportation systems are to continue developing and expanding.

The estimated future capital requirements of the New York Central System may be taken as illustrative of the constant railroad demands for additional funds for improvements and extensions. On the New York Central Lines it is conservatively estimated, on the assumption of a normal growth of business, that the additional capital expenditures for the next ten years will aggregate $50,000,000 per annum. Many of the improvements contemplated are matters of public importance. For instance, the freight terminals in the streets on the West Side of New York city must be modernized and the grade crossings eliminated, involving an investment of probably $45,000,000. New terminals are needed at Utica, Rochester, Buffalo, Cleveland,

Cincinnati, Indianapolis and Detroit; four tracks are required on the Hudson division of the New York Central road and double tracks on many parts of the Big Four, Lake Shore, and Michigan Central lines; elimination of grade crossings in Syracuse, Rochester, Buffalo, Cleveland, Dunkirk and other places must likewise be provided. These are all improvements for facilitating the transportation service. The money used for the purpose must be furnished in large part by the investing public.

New capital expenditures such as those contemplated by the New York Central undoubtedly tend to increase or to maintain earning power. The resulting additional income, however, may not, in some cases, offset the cost of acquiring the new capital. The purpose of new capital expenditure in each instance gives only a partial indication of its profitableness. One railroad may borrow heavily and enlarge its capitalization without augmenting earning power proportionately. On the other hand, a rival system, which does not apply new capital to develop aggressively, is pretty certain to suffer a decline in the net return on its investment. The latter fails to keep up with the improvements taking place around it. Its inferior transportation service diverts traffic to competitors. This loss of business, unless recovered in time, is the first step to receivership and reorganization.

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Business
Organization and Combination

An Analysis of the Evolution and Nature of Business Organization in the United States and a Tentative Solution of the Corporation and Trust Problems

BY LEWIS H. HANEY, PH.D.

Professor of Economics in the University of Texas. Author of "A Congressional History of Railways" and "History of Economic Thought."

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Dr. Haney in his treatment of business organization recognizes two kinds: business that is productive from the social point of view, and business that is productive only from the individual point of view. According to the social point of view, business is productive when it adds to the net sum of goods and services which men want; that is, when the amount of food, clothes, books, automobiles, teaching, medical service, etc., is increased. But individuals may grow rich in ways which do not increase the net sum of goods and services and still be actively engaged in business, or in production from the individual standpoint. A large part of advertising is merely acquisitive, not adding anything, but taking for one business man what another business man loses. So it is with some "speculation" and some middlemen's activities. But all this, when recognized as lawful and when the price is freely paid, Dr. Haney calls "business"; and in the long run, he holds, the test of a good business man is simply the amount of income or private gain which he acquires legally. In his treatment Dr. Haney has recognized "business" to include some activities which add nothing to the sum total of society's wealth.

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